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The Conover Independent Condenser.

We illustrate on this and the succeeding page the Conover independent steam engine condenser, made by Conover Mfg. Co., 95 Liberty street, New York. The complete apparatus as here shown is the outcome of a consideration of the fact that with the high efficiency of the modern steam engine it is necessary, in order to maintain that efficiency when the engine is a condensing engine, that the condenser, which is responsible for one-quarter to one-third of the power developed, shall do its work with good economy. To bring this about, the air-pump must be designed to offer the least possible resistance, and the engine driving the air-pump must consume the least practicable amount of steam in doing it. It is claimed for this condenser that the requirements named are as completely met as can be done without cumbersome and costly construction, which would neutralize any further efforts in the direction of greater economy.

Referring to the engravings, Fig. 1 shows the standard for all sizes up to 2,000 horse-power, and Fig. 2 the form recommended for sizes for higher powers. Fig. 3 represents a cross-section through the compound condensing engine that operates the air-pump, the piston, valves, etc., being shown, and Fig. 4 a side view of the valve gear. Figs. 5 and 6 represent respectively the dash-pot and the boiler feed pump.

In Fig. 1 the condenser is shown at the right, the air-pump at the left, and the engine in the center. The air-pump is vertical, single-acting, and the current of outflowing water, mixed with the air as it comes from the condenser, is always upward. It is a well-known fact that the air rises to the top, and this form of air-pump permits the air to exercise its natural tendency to rise. The air-pump is of the trunk pattern, and being vertical and having the outlets above the valves and stuffing boxes, these essential parts are always automatically sealed with water. The valves are of the best rubber, no springs being required to hold them to their seats, gravity being sufficient. The trunk of the air-pump plunger represents a loss of capacity, but not a loss of power, as the atmospheric pressure is effective in both the upward and downward stroke, thus giving back as much as it takes. It is claimed that this form of air-pump will accomplish its work with the least piston displacement practicable — a very important feature.

As the air-pump is single-acting, doing all its work on the upward stroke and none at all on the downward stroke, the engine on this condenser is made to do the work on its downward stroke called for to operate the pump when making the upward stroke, the engine on its upward stroke furnishing the power necessary to keep the machine up to speed, being ready at the beginning of the downward stroke to do its work as before.

This engine is also of the trunk pattern, and is compound condensing. By referring to Fig. 3, it will be seen that the annular space around the trunk on the upper side of piston forms the high-pressure side. This upper or high pressure side of piston is fitted with a complete Corliss valve gear and dash-pot, adjustable by hand for cut-off. A throttling governor is used to regulate the speed by furnishing the initial pressure that is required for whatever point of cut-off is employed on the engine, maintaining regular speed without requiring adjustments to be made for variations in the boiler pressure or changes in the quantity of injection water. The steam enters the high-pressure side, and is cut off, expanded and exhausted into the receiver shown between the upper and lower valves. This receiver steam is admitted to the low-pressure side of piston by the bottom valve, which has a fixed cut-off at ⅛ stroke. It is then expanded and finally carried to the condenser.

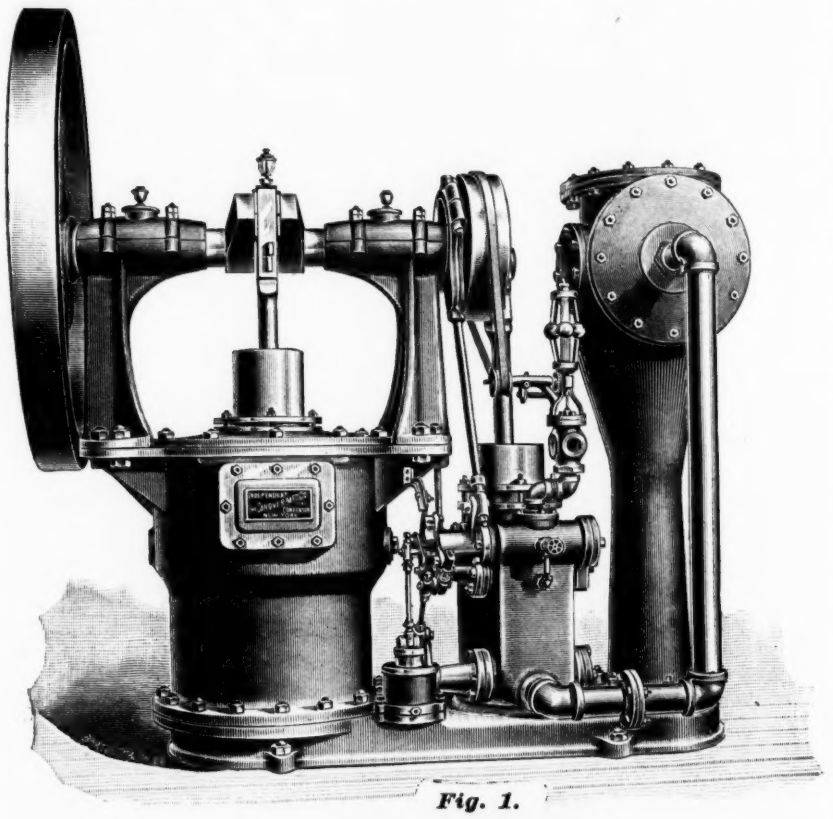


Fig. 1.

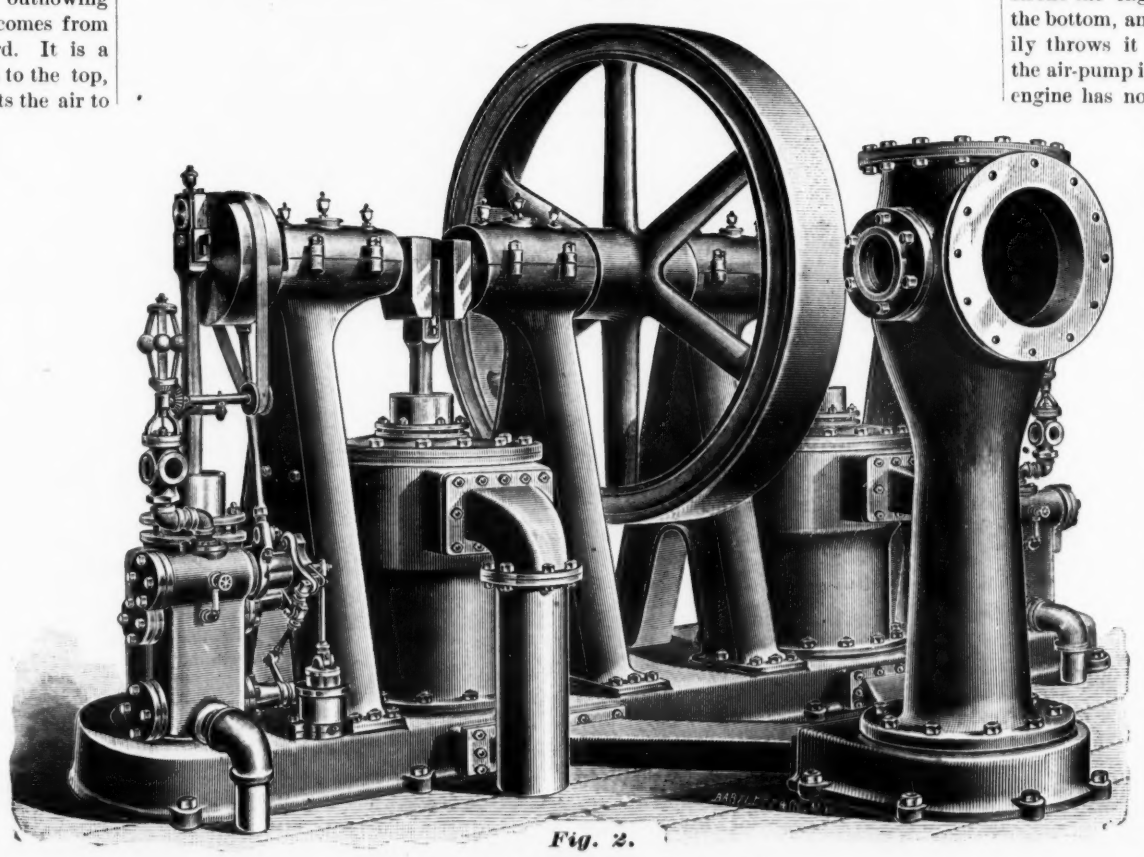


Fig. 2.

THE CONOVER INDEPENDENT CONDENSER.

It will be seen that when the engine is making its downward stroke it has the boiler pressure on its upper side, and the vacuum on the low-pressure or bottom side of piston. This vacuum acts (as the popular expression is) on the full area of the diameter of the cylinder, and in connection with the steam pressure on the top is arranged to be sufficient to cause the pump to make its upward stroke, during which it does all its work. When the pump starts to make its downward stroke the engine is going up with the receiver pressure acting on the lower side of piston; but as the annular space around the upper side of piston is also subjected to receiver pressure, the effective area acted on by the receiver steam is equal to the diameter of the trunk.

It will seen that the engine takes steam once every full revolution. It will also be seen that it is practically single-acting, thereby being especially adapted to operate a single-acting air-pump.

The piston is made so deep as never to expose the top end of cylinder to the vacuum temperature of the bottom end.

The engine crank-pin is not directly opposite the air-pump pin, but is set back thirty degrees. This provides for the full pressure on the engine crank-pin at the time the air-pump is doing its heaviest work; that is, when the air-pump is half-way up on its upward stroke, the engine being set back thirty degrees from directly opposite, practically has just cut off at quarter stroke, and the full boiler pressure is still on the engine piston, and when the air-pump reaches the top of the stroke the engine is thirty degrees back of the bottom, and the balance wheel very readily throws it over past the center. When the air-pump is at the bottom of its stroke the engine has not reached the upper center by thirty degrees, and the fly-wheel is called upon to throw the engine past the dead center. By this time the air-pump has its valves thoroughly seated and the engine is ready to do its heaviest work. From the foregoing it will be seen that comparatively small fly-wheels are needed, and that practically very little power is stored in them.

A special claim is made for this condenser, that it will run without noise. There is no foot valve at the bottom of the air-pump; the condenser, at the right, acts as a water column to give the proper head and force the over-flow water through the valves in the piston, and on the return stroke of the piston this water is easily forced back slightly by the water column, thereby avoiding all shock. The condenser is also made of a special form determined by experiments, and advantage is taken of the velocity imparted to the injection water due to condensation.

The air-pump is brass lined; the plunger is a solid brass casting, and the diaphragm, stuffing boxes, glands, studs, nuts, etc., are made of solid brass, over a ton of brass being used in a condenser of 1,500 horse-power ca-

pacity. In the smaller sizes the amount of brass is about one-sixth of the total weight of the machine.

The double condenser, shown in Fig. 2, has all the special features of the single machine, and for large powers it is desirable, as the two single-acting air-pumps are connected opposite, and give a very continuous and easy motion. A special arrangement provides for connecting the central wheel to either air-pump, thereby making it possible to run either side or the entire machine at pleasure. The spray in the condenser at the end of injection pipe is arranged to catch any floating matter that passes the foot valve screen. This arrangement makes it easy to remove any foreign matter that collects in the spray, which is better than to allow it to go through the air-pump and collect in the valves.

The details of the dash-pot are shown in Fig. 5, which makes its construction quite clear. It will be seen that it differs from the usual construction in that it has its compression chamber inverted, thereby simplifying the construction, and, it is said, rendering its action sure and noiseless, no pipe connections being required to avoid the sounds. The cover is not necessary to the operation of the dash-pot, but is put on to keep off the dirt and to add to its appearance. Fig. 6 shows the boiler feed-pump in cross-section. The valves are arranged to be re-ground while in position by the use of an ordinary wrench. The valve and seat plunger and stuffing box gland are made of brass. The plunger is a working fit in the pump cylinder. The lower connection of boiler feed-pump is a ball joint and arranged for taking up wear.

These condensers are made to be operated by direct steam power, as described, or by belt if desired.

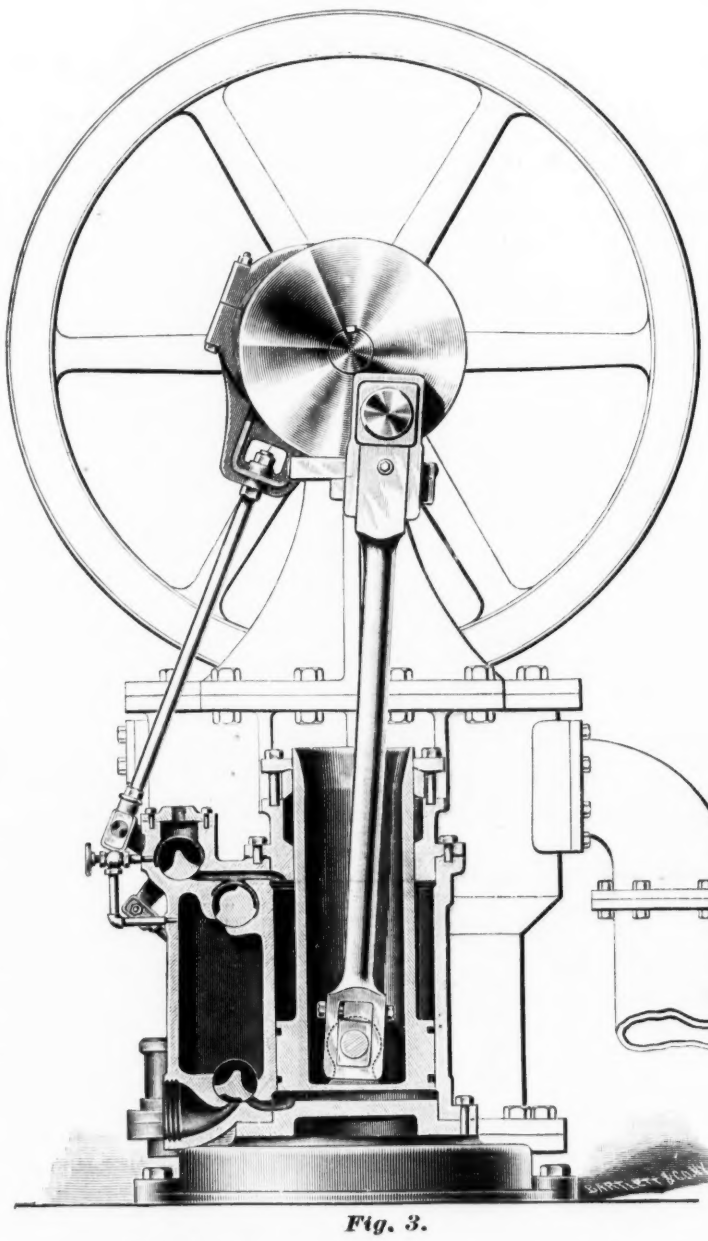


Fig. 3.

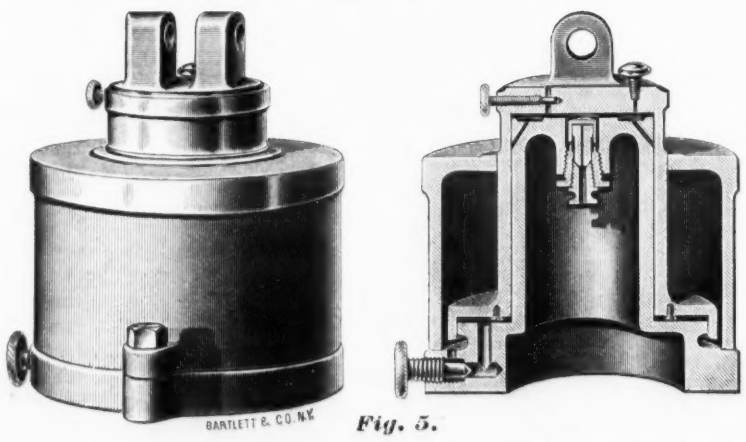


Fig. 5.

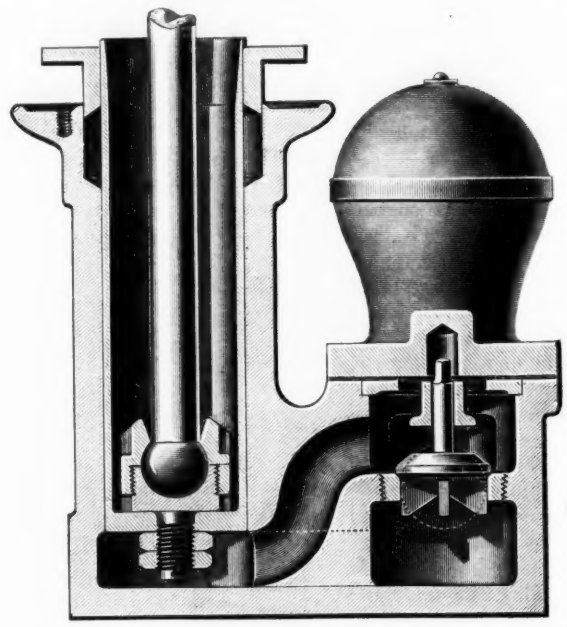


Fig. 6.

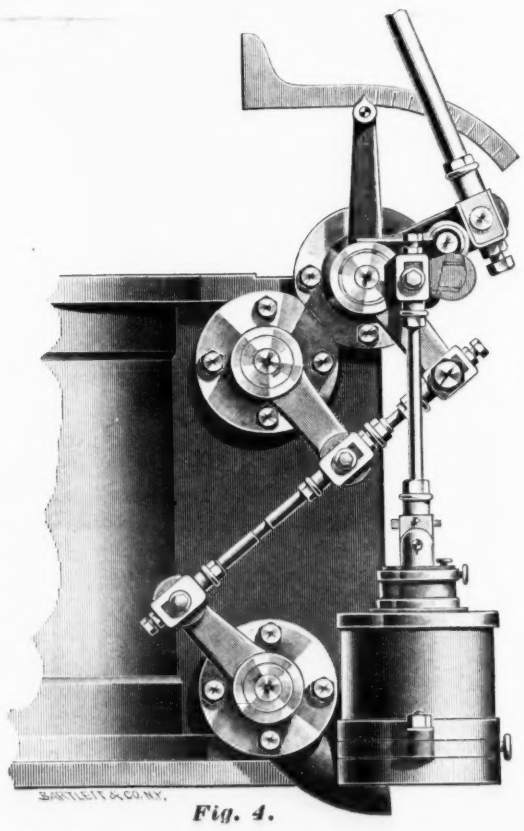


Fig. 4.

THE CONOVER INDEPENDENT CONDENSER.—SEE PAGE 1.

The steady and successful operation of the Gold King stamp-mill at Telluride, Col., by electrical power, from the last of May, 1891, to the present, has been of incalculable benefit, not only to the mining interests of San Miguel, but to those of the State and country in general. It has never been operated a winter through before, but has run this winter twenty-four hours per day and six days in the week from the time it started up last spring. During the time the total stoppage of the mill by reason of the deficiency of power has averaged less than sixteen minutes per day, and of the whole amount of time lost 80 per cent. has been due to necessary work on the turbines and in changing the source of the water supply for mill purposes. Its success has inspired confidence in investors, and its first fruits are seen in the letting of the contract for the building of a 130-stamp-mill on Bear Creek. —*Helena Journal.*

The Mechanical Engineers at San Francisco.

(Editorial Correspondence.)

Just previous to our arrival at San Francisco Secretary Hutton passed through the train and announced that the program of entertainment as laid out for us by our California hosts was so extensive as to make it necessary for us to prolong our stay in the city one day, and leave Friday, the 20th, instead of Thursday. The printed programs when examined showed that every daylight hour had been appropriated for sight-seeing and entertainment, leaving only the evenings for the presentation and discussion of papers in regular session.

I think it will be best, perhaps, to divide the account of what was done there into two, or possibly three parts—the excursions, the regular society proceedings, and the visits to San Francisco's shops being treated separately instead of together in chronological order, which order has been followed thus far up to and including the presentation of Mr. John Richards' paper at the first regular session on Monday evening.

Tuesday was devoted to a most delightful trip around the waters of San Francisco Bay, the new and in many respects remarkable tugboat "Fearless," built by the Union Iron Works for Spreckels Bros., the sugar refiners, being used for the occasion. Mr. George W. Dickie, the general manager of the Union Iron Works, was kind enough to furnish me complete blue-prints of this boat, which we shall probably present to our readers in the near future, so that there is no need for me to give a description of the vessel at this time, except to say that she is 150 feet long over all, 26 feet beam, and is provided with a triple-expansion engine of 1,200 horse-power.

An awning had been erected over the after-deck, under which, in comfortable seats, shelter from the powerful California sunshine was found, the weather on this day, as in fact it was every other day while we were there, being very warm. Our hosts continually assured us that the weather was very unusual, and warned us not to go away from the hotel, especially for a trip by water, without warm wraps and overcoats, for every afternoon, they said, a cold wind came in from the sea, carrying with it a thick fog, the combination being a very chilling one. During our stay, however, this cold breeze with fog did not materialize, and it was a very affecting sight at times to see a masculine member of the party dressed in his warmest suit, carrying over his arm his heavy overcoat, with perhaps unnumbered heavy wraps for his wife, sweltering in the hot sun and sighing for a breath of the cold breeze which never came, and which I am inclined to think many of the party will always consider more or less mythical.

The "Fearless" was first headed out towards the Golden Gate, through which we passed sufficiently to experience considerable of the swell which is always running through the narrow and deep channel, the pale faces and other premonitory symptoms of sea-sickness exhibited by some of the ladies, finally warning those in charge of the excursion that it was time to go about and head for smoother waters. Turning, therefore, we laid our course for Mare Island, where we were to inspect the U. S. navy yard.

Passing through Racoon Straits and up San Pablo Bay, we arrived at the navy yard wharf shortly before noon, and were met there by Commodore John Irwin and Chief Engineer John W. Moore, by whose invitation the visit was made, and who conducted the party about the establishment.

Anchored near by our landing-place was the "Boston," of the White Squadron, to which we had free access, and where we found many congenial souls who seemed to take pleasure in exhibiting the machinery and equipment. Not far away were lying the old and historic war vessels, the "Comanche," "Omaha," "Swartara," "Pensacola" and "Hartford."

Here also for about 25 years past the turreted cruiser "Monadnock" has been under construction, the engines and boilers for this vessel being now practically completed. The engines were standing on the erecting floor of the machine shop, and, so far as could be judged from such hasty examination as was possible, seemed to be a very creditable job. They are of the horizontal, triple-expansion type.

During my walk about the grounds under the guidance of Mr. Wm. F. C. Hasson, who recently resigned from the engineer department of the navy to open an engineering office in San Francisco, we came across an interesting relic of the great storm and naval disaster in the Apian harbor. This was the propeller of the "Neipsic," which was

removed from the shaft here after its encounter with the rocks. It is of manganese bronze, cast in a single piece, all of the blades being more or less bent, and some of them doubled completely back upon themselves, the very little breaking which occurred showing the extreme toughness of the material. It lies upon the lawn in front of one of the buildings used for quarters, and when struck rings as clear as a bell.

The equipment here is partly old and partly new, some very heavy new tools having been put into the boiler and machine shops during the past few years. A set of bending rolls, which are among the largest and heaviest ever built in this country, were shipped here from the Niles Tool Works about a year ago, but have not yet been set up, the parts being housed in a small building outside the main shops. Here also is to be seen one of the finest and most costly dry docks in the world—a beautiful example of stone mosonry which was greatly admired.

Recalled to the "Fearless" by the whistle, we found the deck covered by small tables provided with most good things eatable and drinkable, these being attended to while we steamed back towards the city.

Soon after our first arrival in the city each visitor received a personal invitation to join an excursion as guest of the Spring Valley Water Company, the corporation which is now furnishing and is fixing things so that it must, in the future, furnish San Francisco with its water. Mr. Charles Webb Howard is president and Mr. Herman Schussler chief engineer of the company.

At 9 A. M. of the 18th, therefore, a special train left the station at Third and Townsend streets for Crystal Springs Reservoir. At San Mateo the party took carriages and proceeded to the Upper Reservoir, passing through the magnificent domains of several of San Francisco's millionaires on the way.

The work which has been done here is remarkable in many respects, the concrete dam for instance, being probably the largest structure of the kind in the world. The magnitude and apparent strength of the 145-foot wall, as well as the scenery surrounding it, attracted attention, as did also the statement that the wall had required 250,000 barrels of Portland cement in its construction.

After a further drive of ten miles a point was reached in a beautiful grove where about three hours were spent in eating a most bountiful luncheon and in making and listening to addresses in which the Californians tried to convey to the tourists an idea of how welcome they were to California and its hospitality, while the guests endeavored to frame suitable replies, expressive of their appreciation of all they were seeing and enjoying. Resuming the drive, the train was reached, after which the only stop was a short one to examine the machinery at the Spring Valley pumping station.

For a time after this dam and reservoir were constructed here, they were greatly troubled with a species of water plant which grew so rapidly as to cause considerable annoyance. This plant was found to be relished by some kinds of fish, and a few carp were introduced to keep the vegetable growth within bounds. This was accomplished, but in a short time the carp had so increased that something had to be done to keep them within bounds. Sea lions, being expert fishermen, are now employed for this purpose, and, so far, I believe nothing has been needed to keep them within bounds, though it is in accordance with the general scheme of natural things that there should eventually be established a condition of equilibrium between the plant, the fish and the sea lions.

The originally arranged program provided for the presentation of four professional papers during the day, but after some little previous experience with San Francisco hospitality it was concluded to avoid this by presenting three of the papers at the regular session of the evening before, the remaining one being deferred until Wednesday evening's session, thus leaving the day free for sight-seeing and enjoyment.

Thursday morning (19th) at 8 o'clock the start was made for the Cliff House and Sutro Heights. Mr. Adolph Sutro, the famous engineer and creator of the Sutro Tunnel, having extended a special invitation to visit his famous park and residence overlooking the Golden Gate and the Pacific Ocean, where, under an awning attached to the house, and with an extended view of the Pacific spread out before us, we sat down to a sumptuous breakfast provided by our host, and had the pleasure of listening to an address by him which was full of instructive, entertaining and amusing points, his apostrophe to the mule—the animal "without pride of ancestry or hope of progeny" that had been of so much use to him in carrying on his great work—being especially appreciated.

Sutro Heights occupy a rocky promontory on the south side of the Golden Gate, being in the main about 200 feet above the water. Ten years ago the spot was almost entirely a barren waste, but Mr. Sutro saw in it the possibilities of an earthly paradise, and it is nearly that that he with abundance of money and a most favorable climate to help him, has made of it. The grounds are beautifully laid out with lawns, trees and shrubs, while the air is filled with the perfume of the rarest and most beautiful plants from every part of the world. Many statues and copies of the most famous statues of the old world are placed about the grounds, the combination of art and nature being a most happy and pleasing one.

Near by, and a short distance from the cliffs, is Seal Rock, which at the time of our visit was covered by hundreds of seals or sea lions, whose continual barking, contortions and expert swimming were watched with much interest. Just at present the work that Mr. Sutro is especially interested in is the construction of a mammoth aquarium and bathing place which is being constructed of stone masonry in the most substantial manner, the work so far done having evidently involved the spending of a princely sum. Near the base of the cliff a basin has been formed by excavating the natural stone, the outer wall of this basin being at such a height that the breakers at high tide break over it, and thus fill the basin with water, taken from the crests of the waves. From this basin the water passes through a tunnel cut in the rock and guarded by massive gates, to chambers, in which, by the formation of eddies, the sand is deposited and drawn off to be returned to the sea. From here the water passes to the aquarium, which is built of stone about a large natural rock. From here the water passes to the bathing tanks, which are large enough to accommodate multitudes of people, and are provided with trenches running across the cemented floors, in which are to be placed steam pipes for obtaining any desired temperature. These trenches are covered by slabs of natural stone cut to fit in place, so that the floor is smooth and even. All this, it is understood, is to be, as the rest of the grounds now are, free to the public, the only restrictions imposed by Mr. Sutro upon their use being those reasonable and necessary ones needed to preserve the beauty of the grounds.

Shortly after noon carriages drove up in front of Mr. Sutro's residence, in which the party, after bidding their host adieu, drove through the Golden Gate Park and the city to the region of the industrial establishments, where the remainder of the day was spent in looking over the Pacific Rolling-mills and the Union Iron Works.

In the evening, at the Academy of Sciences Building, a lantern slide exhibition was given, the slides being mainly representative of special machinery used in and about the mines of Nevada, particularly at Virginia City. The views as they were thrown upon the screen were explained by Mr. W. R. Eckart, who has had much to do with this machinery as consulting and constructing engineer. He was assisted in the exhibition by members of the California Camera Club, and the pictures were much enjoyed. At the conclusion of this the men proceeded to the residence of Mr. and Mrs. Hallidie, where the ladies had preceded them, and where a reception was held, during which, in addition to social pleasures, we listened to a very interesting account of a trip across the continent made in the days of the early gold discoveries, the account having been written by a lady, who, with her family, was a member of a party which crossed by wagon train. The account was read to us by the author's daughter, and formed a very strong contrast to our more recent crossing in a Pullman train.

Such intervals as could be found in the round of excursions and other forms of entertainment were devoted to exploring the city, Chinatown being, of course, the chief attraction for curiosity seekers. Here John Chinaman and his way of doing things can be studied as nowhere else, though, of course, it is not likely that things as they are found here fairly represent China or what Chinamen would desire under other and better conditions. San Francisco people generally are heartily sick of the Chinese, and look upon their presence as a blight—a moral plague. With a guide and one or two others I saw something of the Chinese quarters, and saw much that was disagreeable and disgusting. But most large cities have such sections, and I saw nothing in Chinatown which made me so heartsick as things which I have seen in Mulberry bend, Mott and Baxter streets, New York City, and which I believe are the result chiefly of wrong social conditions, shared in to a greater or less extent by all large cities.

F. J. M.

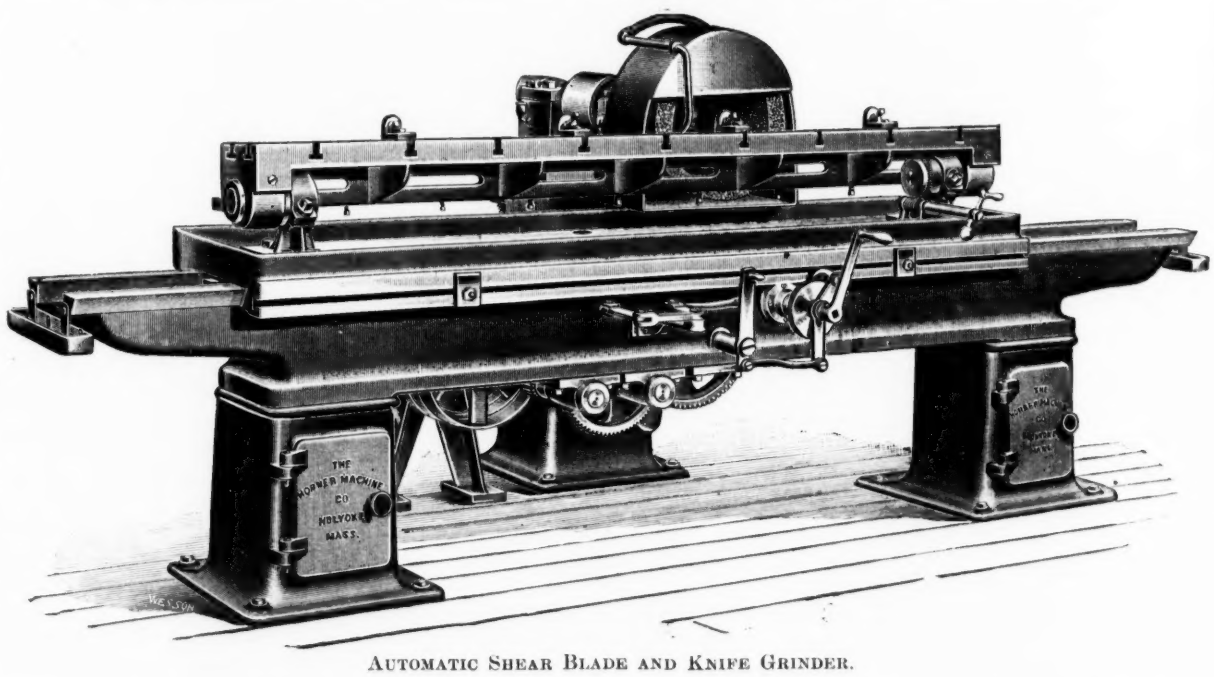
Automatic Shear Blade and Knife Grinder.

The accompanying illustration is of a machine intended for grinding metal-cutting shear blades, paper or planer knives or any other work of that character, and is made in sizes to grind up to 12 feet long if desired. The machine is also adapted to receive three T slots instead of being provided with the knife-holder as shown, and it is then fitted for grinding almost any sort of plane surfaces, such as scale beams, guide bars, etc., or, where desired, the machine can be supplied with facilities for doing both kinds of work.

A cup wheel is ordinarily provided, and runs in a safety casing or hood, but an ordinary disk wheel can be used if desired.

The driving mechanism is a double train of cut gearing and rack, the belts beng automatically shifted. The work is automatically set in towards the wheel .002″ at the end of each stroke. The column which is under the head of the machine is utilized as a reservoir for water, a simple rotary pump being placed within this column for supplying water to the wheel, which is returned to be again used. The machine is intended for doing a better class of work than can usually be done on machines of its class, and is accurately built with sufficient bearing surfaces to give durability. The spindle is 2¼″ diameter and runs in self-oiling boxes 8″ long.

The machine is built by the Horner Machine Co., Holyoke, Mass.



AUTOMATIC SHEAR BLADE AND KNIFE GRINDER.

Gascon Discourses Upon Some Shortcomings in Text-books.

BY JARNO.

Several times I have drawn upon acquaintances for matter to publish. Gascon has been in a communicative mood, and I have asked him to let one of his shorthand writers take notes. He hands me the following paper, which I mail without change. I have several of my own papers that have been put away unmailed, because, as they approached completion, their value seemed to fail. About my desk there are, in various stages of elaboration, more papers than all that I have ever submitted to the editor for approval. Some of them were dropped because their subjects, though uppermost in mind at the beginning, had at the end sunk beneath the surface of the common-place. One of the papers failed as to its facts, inasmuch as it stated that the driven disk of a friction feed mechanism should not be the one covered with leather, because, if covered with leather, depressions would be worn, and the feed would not work. Now, this statement became stale to me, when I saw, in a neighboring shop, a leather-covered driven disk that had worked for years. But let Gascon speak:

"It is easier to tell a story than to write a homily; in fact, one of the most thankless tasks is that of imparting information for others' guidance. The writing of text-books is a task something like this, which may be a reason why some text-book writers are not more careful. This want of care should be avoided above all others: when a man assumes to be a teacher, he should be certain that his teachings are correct. Worse than carelessness is the refusal of a writer to tell what he knows about his subject. To pretend to point the way, and to point wrong, is worse than not to point at all; but purposely to withhold important information pertaining to the subject is a misdemeanor.

"Before I finish I wish to say something on mechanical text-books, but just here I will quote literally from a dictionary printed in Glasgow by Wm. Collins & Co.; the title page is gone, so that I do not know who is the publisher: 'Bevel Wheels—Wheels working in different places, having their teeth cut at right angles.' If so senseless a mixture of words were compounded by the shadowy 'Tom Collins,' we should not be surprised; but when it is in a dictionary purporting to instruct in the use of correct English, we can conceive why some philosophers assert that material things and causes of sensation are not real, but only appearances, and that nothing but thought is real. Whoever wrote this dictionary was one of these philosophers, and supposed that facts will conform to a meaning, if one can be dug out of any mixture of words that he might choose to compound; it would make no difference how he described a well known mechanical device; the device will fit his description, his thought is real; mechanical practice the appearance. Seriously, the writer must have had something in mind. A man may misplace things in a fit of absent-mindedness, but how he can pen a mixture of words that is absolutely without meaning is a puzzler. The nearest to a solution that I can offer is, that the writer undertook to copy a description something like this: 'Bevel Wheels—Wheels working together in different planes, having their teeth at right angles to their pitch cones.'

"In my office desk is a copy of Webster's Academical Dictionary, in which is a pretended representation of an epicycloidal curve. The curve is shown as being both outside and inside the base circle, and, as if to add still more to the error, the curve forms loops inside. If academical text-books contain so gross errors as this, I should think that college graduates would have something to unlearn before they can make use of their knowledge. I am glad to note that Webster's International Dictionary has decided to restrain its epicycloidal, so that it shall not cross over the base circle.

"Now I am going to assert that mechanics are not so prone to write upon subjects that they do not understand. Who has ever known a mechanic to try to write an explanation of a law term or a medical term? I will admit that I have known a mechanic to try to preach, but I have not known a good mechanic and a good preacher to be combined in one man.

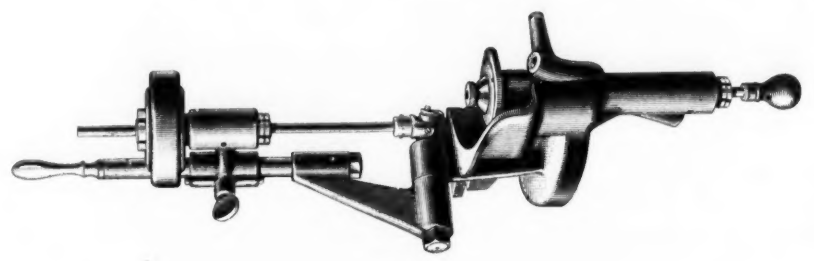
"If I were to preach to the dictionary makers, I would exhort them to call in a mechanic before sending their definitions of mechanical terms to the printer."

A New Center Grinder.

The engravings herewith represent a machine for grinding centers in place; one that can be quickly placed in the lathe without any more care or attention than is required in setting an ordinary lathe tool, the simple act of placing the machine upon centers, and clamping in tool post, giving both the angle and the position of wheel axis in same plane as that of the lathe spindle.

The machine is carefully designed and accurately constructed, the parts subjected to wear being covered for protection. It is designed for centers of 60° angle.

Referring to Fig. 1, the operation is as follows: Place the bar *A* loosely in the tool-post; then place the machine on the lathe centers at *B B*, screwing up the tail slide firmly. Adjust the raise and fall rest or tool blocking, as the case may be, until the bar *A* rests squarely upon it. Screw up the tool-post screw, withdraw the tail slide, move the lathe carriage until the machine is in a position similar to *C* in Fig. 2. Press the rubber pulley *D* against the lathe cone, first having placed the belt upon the smallest step, and run the lathe with or without back gears, as may be preferred. The cut of wheel is adjusted by the cross slide handle of lathe. The wheel is moved across the surface of center by means of the handle *E*. The adjustment at *F* provides for different-sized lathes. It will be noticed that the lathe requires no change to use the grinder, even the dog plate remaining in place.



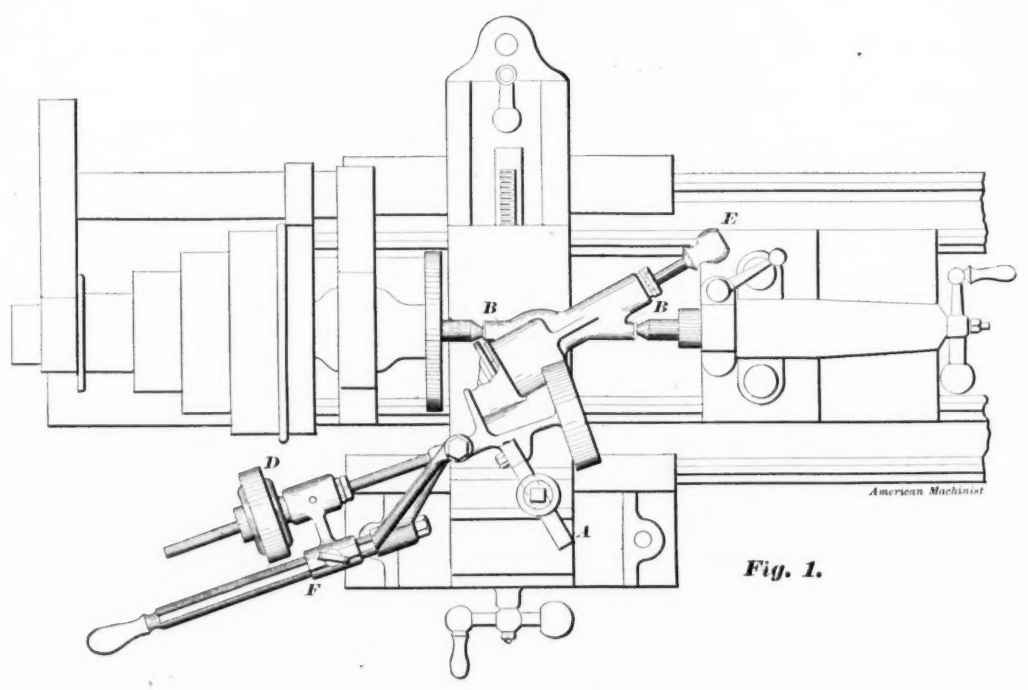


Fig. 1.

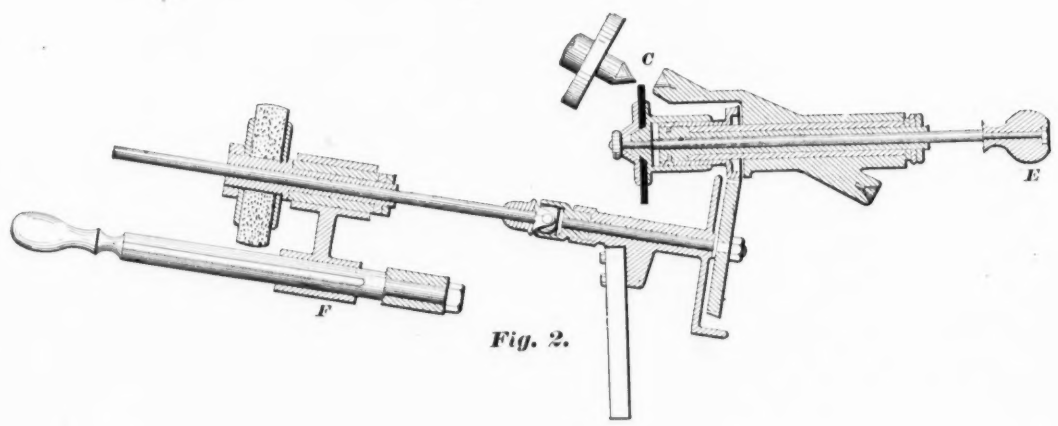


Fig. 2.

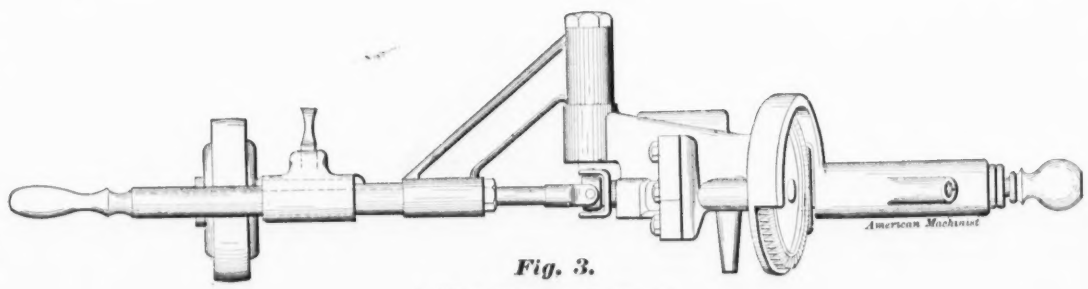


Fig. 3.

A NEW CENTER GRINDER.

Fig. 1 shows the machine in position on centers of lathe. Fig. 2 is a section showing the coverings of the parts and general construction. Fig. 3 is a side elevation

The manufacturers are Leland, Faulconer & Norton Co., 96 Bates street, Detroit, Mich.

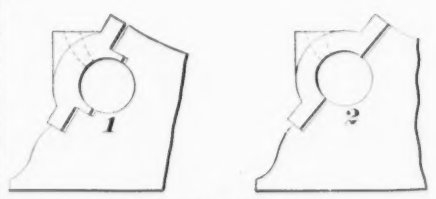
Experience with Engine Bearings.

BY BELL CRANK.

With the beginning of the high-speed engine era came the necessity of making better bearings for the crank-shaft than had before been used. The first experience I had was with babbitted bearings of the form shown in Fig. 1. They were fitted up with great care, the cap being a planed fit to the main frame at all points of contact, and the babbitt hammered in the seat and bored to fit the journal. Hard wood liners were put in the joint before boring, and therefore fitted the shaft, thus preventing the oil being scraped off the journal at the bottom. Liberal sized oil grooves were cut in the babbitt to carry the oil to all parts of the bearing, and the cap had a large grease cup cast in it. The other part of the bearing was supplied from a graduated feed oil cup. The engines having these bearings were not really high speed; the piston speed was 600 to 700 feet per minute, and the stroke was about twice the diameter of the cylinder, yet, with all the care bestowed, the journals never would run cool, and in many cases they would always have a temperature so high that an engineer who had no experience with them would at first think they were in such a condition that they would get fatally hot on a very slight provocation. At this apparently critical temperature they would run for weeks if the oil supply was liberal, but would get no better, and if the oil supply ceased for a few minutes they would get hot enough to start melting the babbitt.

I erected and started engines with this sort of bearings for several months with about the same results, when I began to think it was due to improper setting of the bearings, and I tried the plan of turning the shaft by hand in the bearings, and scraping them to a good fit. I tried this on three engines, and found that I did not get enough benefit to pay for the labor, for with proper care in setting it could be brought to a good general bearing without scraping, and after a week's run you could hardly tell from the appearance of the bearing whether it had been scraped or not. By this time I settled down to the conclusion that it must be a high-tempered thing anyhow, and must be nursed and have every want supplied at once, or there would be no peace. Not long after this time I dropped down into a town in Pennsylvania, and into a shop where a line of cheap-looking medium speed engines were built. I found the bearings were made as shown in Fig. 2, and were babbitted, but not bored, and the scraping was very superficial and scattering. Neither the cap or its seat were planed, but were simply the cast surfaces, and the liners in the joint were soft pine and strips of pasteboard or paper. The only thing that kept the cap in range with the other half of the bearing was the jog it rested on at the bottom edge. The back half of the bearing was babbitted first, and then the cap was put on and screwed down tight on the liners, and then poured. After being scraped, two more paper liners were put in, and this was supposed to be enough to keep the shaft free when the cap was screwed down. After seeing this thing and process, and making a mental comparison with the carefully made bearings I had been accustomed to, I felt as if I wanted to go somewhere soon, for I thought there was no hope for such a half-breed engine bearing as that. Fate, however, decreed that I was to see the thing to its bitter end, so I set one up very carefully, and rubbed the shaft in place, and took it out and scraped until it had a good average bearing, for I thought it needed all the help I could give it at the start. I started up the engine, and gradually got it up to full speed, in the meantime spending most of my time feeling for a rise of temperature. Judge of my surprise when I found no indications of heating. I then put the load on and ran it several hours, and the bearings did not get much above a lukewarm temperature. Following this, I had similar experience with different sizes of bearings made the same way, and in every case I found them to be superior to Fig. 1, and they proved to be very durable and easy to take care of.

I suppose some of your readers will think I have been writing a poor quality of fiction, but I can assure them that it is real experience. I have a theory by which I explain these facts, but as this theory is not entirely satisfactory to me I will not give it at present; but if any of your readers can give a satisfactory explanation, I hope they will do so.



ENGINE BEARINGS.

The iron trade in England appears to be in a depressed condition.

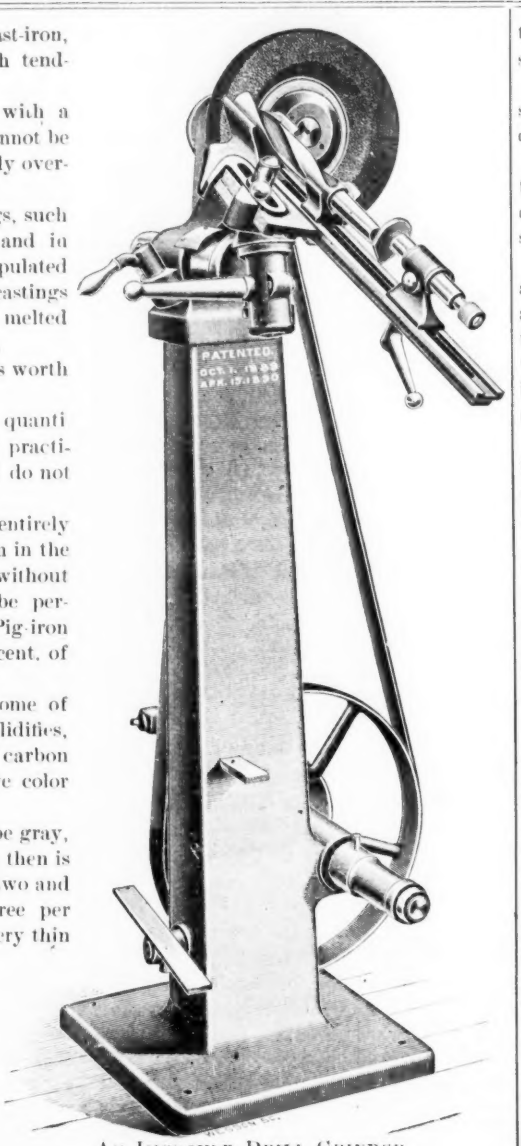
An Improved Drill Grinder.

The Worcester drill grinder is a well-known tool in machine shops, and has been already illustrated in our columns in some of its earlier forms. As it has been heretofore made it has been necessary to turn a hand-wheel and screw until a pointer placed on a moving slide came to a graduation corresponding to the diameter of the drill to be ground.

But a good many drills have no sizes marked upon them, or, having had them when new, the figures have become obliterated in ways that are familiar to most machine shop men. For this reason, and also because the new construction makes the tool more convenient to use, the hand-wheel and screw with graduations have been done away with, and in their place there are two caliper jaws, between which the drill to be ground is first placed, and these jaws being closed upon the drill, and the clamp fastened, the machine is adjusted for grinding that drill without further attention.

The other points of the machine, such as its simplicity, its use of a wheel of such character and in such a way that the perfection of the grinding is not dependent upon the accuracy of face of the wheel; its large range of capacity, etc., need not be dwelt upon, as they are familiar to most of our readers.

It will be noticed also that the machine has been mounted upon a neat column, to which is attached the countershaft, so that it is entirely self-contained, and the machine is started or stopped by the foot-treadle seen in front near the floor. It is made by the Washburn Shops of the Worcester Polytechnic Institute, Worcester, Mass.



AN IMPROVED DRILL GRINDER.

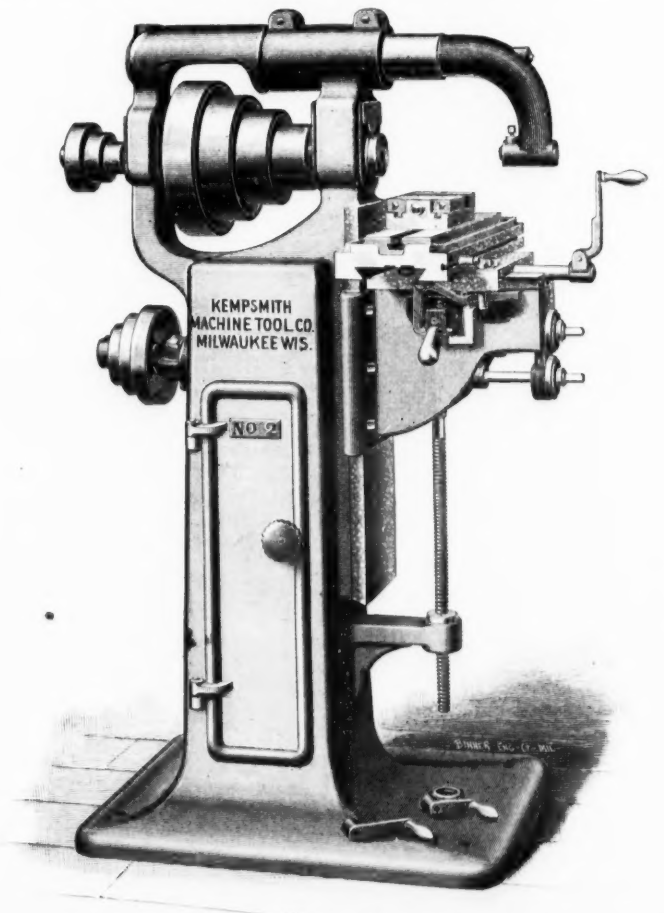
Plain Milling Machine.

We present on this page an illustration of a plain milling machine which has been designed especially for such light work as is done in electrical shops, gun, sewing machine and bicycle factories, where pieces must be duplicated in large numbers and at minimum cost.

The general design of the machine is the same as the larger machines by the same makers, the Kempsmith Machine Tool Co., of Milwaukee, Wis.—their universal milling machine having been illustrated and described by us in issue of October 30, 1890. In this machine the arrangement of the head is the same, the cone pulley being reversed to give opportunity for more thoroughly bracing the front standard, and the two standards being tied together by a sleeve through which the arm passes. As illustrated, the cone has four steps for a 2″ belt, but it is also made with three steps for a 2¾″ belt where preferred, the largest step in either case being 10½″ diameter.

The knee has a vertical movement of 14½″, and the saddle a cross movement of 3¾″ upon it, both these movements being graduated to read to thousandths of an inch. The table is 24″ long, 6¾″ wide, and has an automatic feed of 18″, which is tripped automatically at any desired point with the table moving in either direction. The feed gearing and the universal joints are covered and protected from dirt and chips.

Everything shown in the engraving, and a countershaft besides, accompanies the machine, this countershaft having two friction pulleys 10″ diameter for a 2¾″ belt.



PLAIN MILLING MACHINE

Silicon in Foundry Mixtures.

BY W. J. KEEP *

Thin castings for light hardware and for stoves must be soft and gray, and must have as little tendency to chill as possible.

The chilling tendency which some irons possess seems to be independent of chemical constitution, and was imparted to the iron in the blast furnace.

In such irons some peculiar relation seems to exist between the silicon and the carbon, which causes the iron to be white, if suddenly changed from a liquid to a solid.

Some ores produce a chilling cast-iron, and when smelted with charcoal such tendency is increased.

When the iron has been made with a tendency to chill, such peculiarity cannot be removed, though it may be partially overcome for the time being.

Therefore, for stove plate castings, such chilling irons should not be used, and in making purchases it should be stipulated that the pig-iron bought shall make castings free from chill when such pig iron is melted in a crucible under proper conditions.

In this case, prevention of chill is worth much more than any partial cure.

Phosphorus and manganese in the quantities usually found in pig-iron have practically no influence upon the iron, and do not influence chill.

The grayness of thin castings is entirely caused by the carbon and the silicon in the iron. The presence of either one without the other will cause the casting to be perfectly white and extremely hard. Pig-iron will not contain more than four per cent. of carbon.

The presence of silicon separates some of the carbon from the iron just as it solidifies, and it is the imprisoned particles of carbon that are caught in the mass, that give color to the iron.

Without silicon the iron could not be gray, but would always be white. Silicon then is a necessity in gray cast-iron. From two and one-half per cent. of silicon to three per cent. will give the best results for very thin castings. The open gray foundry irons used for thin castings will contain about this quantity.

Molten white iron is thickly liquid, and fluidity is given to melted iron by so influencing carbon that, when the iron cools, a portion will change into graphite. The larger the percentage of graphite after the iron is solid, the more fluid will he iron be while molten, and before the graphite separates.

As silicon is the agent which causes the formation of graphite, it is silicon which causes cast-iron to be fluid. It has been said that phosphorus causes iron to be fluid. It does cause it to remain fluid some longer, but probably does not make it more fluid.

Pig-iron is produced in the blast furnace with more or less shrinkage, which is independent of chemical constitution. Therefore, selecting iron that will produce castings with small shrinkage is the best method for reducing shrinkage.

Graphite is very bulky, and as it separates in the iron after the iron is in the mold, and at the instant the iron becomes solid, it takes up more room, and the castings are larger according as the quantity of graphite is increased. Silicon is the sole cause for the formation of graphite, therefore silicon reduces shrinkage. Fluidity and lessening of shrinkage will cause the edges of a casting to be sharp; silicon therefore makes perfect castings.

If an iron has a tendency to chill, by increasing silicon the depth of chill may be decreased while the silicon remains in the iron, but if the silicon is again diminished the chill will return; therefore we say that silicon reduces chill.

White iron is brittle, while gray iron is somewhat ductile; therefore silicon adds ductility to cast-iron.

Gray iron is softer than white iron; therefore silicon, by making iron gray, softens cast-iron; hence the name of softener for silicon iron.

If pig-irons are used in such proportions as to give about three per cent. of silicon, and are melted in a cupola furnace in contact with the fuel, considerable of the silicon will be driven out of the iron, and the castings will not contain as much as the pig metal.

Sulphur will cause silicon to leave molten iron, and as all fuel contains some sulphur, the melting of iron will reduce the silicon that it contained while in the pig.

Sulphur is not evenly distributed throughout the fuel, and cannot be distinguished by the eye; therefore, any carload of fuel may contain more sulphur than was expected, and the result will be an increased expulsion of silicon, and consequently close-grained, hard, light-colored castings.

In every day practice we can only know the presence of sulphur in the fuel by the results, and such knowledge comes after the fuel is burned, and therefore it cannot be guarded against. The sulphur does not stay in the casting. It does the harm and passes out of the stack. The blast of air also burns out some of the silicon. As next day a considerable portion of this close grained iron must be returned to the cupola, the closeness and hardness is increased as the silicon is diminished.

To make a mixture of iron for light castings, and run a cupola which shall produce a uniform soft gray product, is simply a question of keeping the silicon up to between two and a half and three per cent. of the mixture.

It makes little difference where we obtain the silicon, if we only get in enough to keep up the percentage. If we admire dark castings and a dark open grain, it is best to use a large quantity of dark open-grained pig.

The reason for this is, that each time the iron solidifies, the silicon drives some of the carbon entirely out of the iron, and repeated re-meltings therefore reduce the carbon as well as the silicon, and, as the dark color came from the carbon, its expulsion causes the castings to be lighter in color.

The only way to renew carbon and silicon at the same time is to use plenty of No. 1 pig iron, but as this rarely contains more than three and one half per cent. of silicon, it will be impossible in this way to increase silicon rapidly, and if a second dose of sulphur should follow the first, it might be difficult to soften the castings quick enough to prevent loss.

No. 1 pig-iron, especially that which is dark-grained, is expensive, and while it is a fact that the more carbon there is present, the less silicon will be required to produce a given grain, yet additions of silicon by the increase of No. 1 iron will, in any case, be expensive, and will need very close attention.

We might call the adding of silicon and of new graphitic carbon by means of No. 1 pig-iron the natural way to produce gray castings.

The other way, which may be called the artificial method, is to purchase irons that can be bought most cheaply, and bring up the silicon by additions of silicon pig. This will turn the carbon of the iron into graphite and make cheap, hard irons, soft and gray. This method will produce close-grained castings, light in fracture but strong and soft. If there is sulphur in the fuel to lessen the silicon, an increase of silicon pig will restore the silicon at once.

In this way with cheap irons, which are easily procurable, as good castings can be made as with higher priced No. 1 iron.

This method has some other advantages. The adding of silicon to the melted iron artificially forms graphite after the iron has entered the mold, and just as the iron solidifies. The graphite which reaches the surface of the casting forms a facing between the iron and the sand of the mold, which is

* Paper read before the National Association of Stove Manufacturers at Chicago, May 4.

more effective than facing shaken on, and gives the casting a glistening silvery surface.

The reason for the grain being closer, and the carbon being diminished, is that high silicon iron contains less carbon than No. 1 or No. 2 gray foundry iron, and, therefore, at each addition the carbon will become less, and the castings will grow lighter in color.

Before closing, let us say a word regarding silicon pig-iron. As silicon drives out carbon, the higher the silicon the less the grain in a pig-iron or casting. Pig-iron containing ten per cent. of silicon has very little grain, and with fifteen per cent the grain is generally absent, and high silicon irons are often full of blow-holes. Pig-iron with from four to six per cent. of silicon can be produced at ordinary blast furnace temperatures from suitable ores, but to obtain the higher percentages a furnace must be run at an unsafe temperature.

The high grades are therefore more expensive, and being deficient in carbon, are no better for use than the lower grades, which are more easily and cheaply obtainable.

As to the kind of silicon iron to use, it makes but little difference where the silicon comes from. One iron is about as good as another, if the same rules regarding chill and shrinkage are observed as are applied in the purchase of gray pig. Very high silicon irons will often give quite a deep chill, and must, therefore, be avoided. The location of the foundry will determine what irons are most desirable to purchase, and it will take some experiment to find out which irons will go best together.

We sometimes hear of some one who does not believe in the use of silicon iron, or who has not produced good results by its use.

It must always be remembered that for soft gray castings as thin as stove plate, the silicon should be about two and three-quarters per cent.

If your castings already contain that amount, it will result in damage to make it higher.

The only place to use silicon iron is in a mixture deficient in silicon.

For machinery castings, which should contain about one and one-half per cent. of silicon, mottled and low grades of gray foundry pig-iron may be used, and if more silicon is needed, a little No. 2 or No. 1 may be added, it being an easy matter to keep up the silicon, or very close gray, and even white pig-iron and burned scrap may be used, if the required percentage of silicon is restored by additions of No. 1 pig, or by silicon pig-iron.

A difference of opinion exists as to the number of brands of pig-iron to be used at one time. It is impossible to run a blast furnace regularly. The silicon varies considerably in the pigs made from one cast, and a furnace is likely to go wrong at any time. It is impossible to refuse iron made at such times, if it were possible to determine when the iron was not such as was purchased. It is therefore best to use a variety of makes of pig-iron in making up a mixture; the greater the variety the better. Then any temporary variation in one or two of the irons will not materially influence the castings.

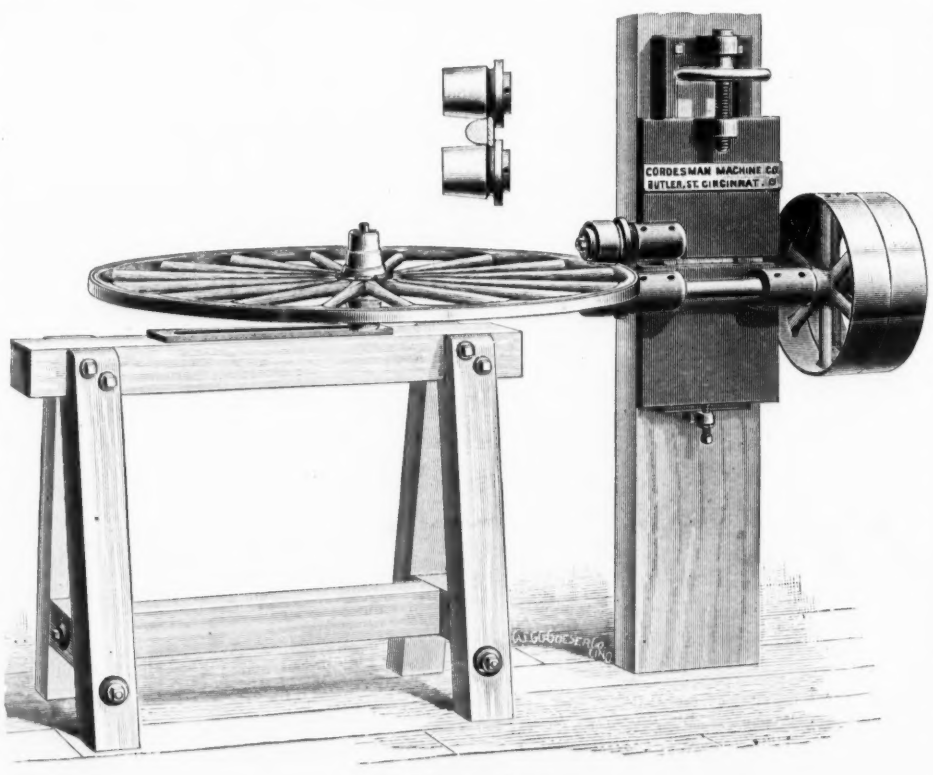
It is sometimes claimed by the blast furnace manager that it is better for him to make a proper mixture of ores in the furnace, so as to produce exactly the iron desired, and sell the iron on a guaranteed analysis, and not trust to the foundryman's judgment as to what a mixture should be. It would be a good idea for all furnace men to produce this kind of iron if they are able to do so, but as their furnace may go back on them several times in a week, it is better to have several brands of such irons mixed together, for the reasons just given. If any variation should then occur to influence the castings, a small addition of silicon pig will set all right at once.

Tire Truing Machine.

When tires are shrunk on to the felloes of carriage or wagon wheels, they are very apt, especially where the work is done hastily, to be out of truth laterally, *i. e.*, they project from the felloe varying amounts at different points. The machine which we illustrate herewith is designed to correct this, the manner in which it accomplishes the work being obvious from an inspection of the engraving.

Bolted to a post is a plate upon which two other plates are fitted to slide, each of these latter plates carrying a roller. The lower roll is driven by the pulley seen, while the upper one is driven by friction with the revolving wheel, it being pressed down upon it by the hand-wheel and screw seen above. The wheel is supported upon a stud which fits into a T-slot in a plate attached to the trestle frame as shown, and one revolution of the wheel trues it, and, of course, leaves it in better condition than where a hammer is used, as it is free from disfiguring marks.

The rolls are made of steel, hardened, and the frame of hard wood drawn bolted and finished in shellac. The machine is made by the Cordesman Machine Company, Cincinnati, Ohio.



TIRE TRUING MACHINE.

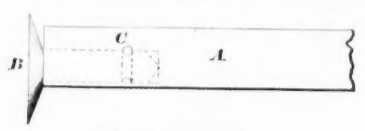
LETTERS FROM PRACTICAL MEN.

Turning Paper.

Editor American Machinist:

I am impelled to write because, as I think, the "other fellow" did not enlighten your inquirer as to the *best* tool to use in truing paper friction wheels.

Twenty one years ago I was a sort of assistant engineer in the erection of one of the largest saw-mills built up to that time, and as it was what would be termed a friction-mill, *i. e.*, all its important power transmissions



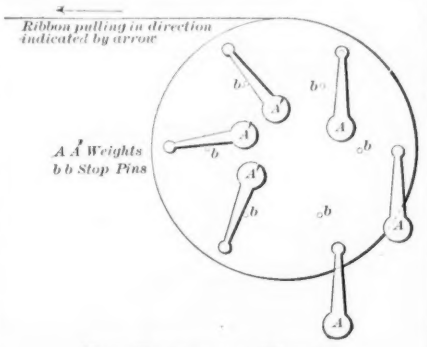
TURNING PAPER.

from a 500 H. P. engine were by means of friction gearing, I had a good bit of experience in dealing with both paper and wood friction gearing. At first the turning of the wheels was a very tedious and unsatisfactory process. Tools containing in one form or another the different ideas shown in your last few issues by as many correspondents were tried, and found so glaringly inadequate that a little extra mental steam was put on and a tool evolved which was a thing of beauty and a joy to the turner.

A glance at the accompanying sketch will show the tool referred to. *A* represents the butt end of a common lathe tool with a $\frac{5}{16}$ hole drilled in say $1\frac{1}{4}$" longitudinally.

B indicates the cutting tool, which consists of a button of about $\frac{3}{4}$" diameter, having a nicely turned shank fitted to occupy and revolve freely but snugly in the hole in *A*. The shank is "necked" and a small pin *C* inserted, to prevent longitudinal motion of the shank and its head. Any lathe hand will, of course, understand how to set and use the tool.

One peculiarity of this tool is that it is practically self-sharpening, the button being



NOT PERPETUAL MOTION.

abraded on the plane side, so that in some cases it is sharper at the end of a long cut than at the beginning.

The speed of the lathe should be such that the friction of the revolving button does not generate too much heat.

When properly managed this tool will make a long paper friction roller shine from very perfection of surface.

C. C. HILL.

Not a Perpetual Motion Device.

Editor American Machinist:

In your issue of May 19 you make a statement in your editorial headed, "Some Perpetual Motion Schemes," that is evidently contrary to well-known principles, and as you are usually correct in your criticisms and answers to disputed questions, it seems strange that you should have been misled by such a simple device as the one you mention as having been patented in connection with a typewriter. I do not know, and cannot tell from your description, exactly how the device is made, but I inclose a sketch of a device which will evidently accomplish the same purpose as the one patented, viz., to continually resist the motion of the ribbon as it is wound upon the other spool. You say in regard to this, "But, of course, if it will continually resist motion more than that due to its friction, it would produce motion in the opposite direction, and it is nothing more than a perpetual motion device, pure and simple."

There are dozens of ways of effecting a resistance to continued movement in one direction by means of weights, none of which will make more than one-half revolution in an opposite direction if left to themselves. The inclosed sketch represents one of them, which I have tried and found to be a simple device for the purpose. As you can readily see, the removal of tension from other end of the ribbon would allow the disk and the weights to drop back about one-half turn, or until the weights *A' A' A'* were all hanging in positions corresponding to *A A A*.

I think you will see that your designation of a device of this kind as a "perpetual motion device" is not proper. B. W. HOYT.

[Our language as quoted by Mr. Hoyt would obviously apply to the device shown by him, and is therefore erroneous to that extent, as what he says of the device is correct. We have reason to believe, however, that we were correct in designating the patented device as an attempt at perpetual motion, though we are not in a position to give a demonstration of it.—ED.]

Old versus New Catalogues and Price Lists.

Editor American Machinist:

Your columns abound in helpful suggestions in regard to a good many of the failings of human nature, but there is one peculiarity which I have not seen mentioned. This is the belief in the minds of some men, who otherwise are sensible, that certain classes of those with whom they deal will always run in the same ruts, and never make any changes. Men of this kind always cling to old catalogues and circulars, and it is for their benefit that the makers of catalogues issue their almost pathetic appeal to "use care to destroy old catalogues, and only keep those of the latest edition on hand." To these men, quotations and price lists also seem to be made for eternity, and it is on account of the carelessness of such people that a good many manufacturers deem it inexpedient to put their prices in their catalogues.

One of these men within the writer's experience purchased a machine for about $700, because, relying on an old catalogue, he believed he could not duplicate one of his old machines for less than $800, while, as a matter of fact, the maker of the old machine had reduced his prices, and would have sold him one for $600. This incident caused that manufacturer to discontinue the printing of prices of machine tools in his catalogue, "making it necessary for all *wise men* [as one of my associates somewhat roughly expressed it] to take time and use a two-cent stamp to procure quotations, because *fools* would persist in using old catalogues."

Another phase of this peculiarity is the failure to ascertain or bear in mind that you are making new lines of tools. Such a man will say to you, "I did not think that you made shapers, although, now you speak of it, I think I have heard so. At the time I bought my shaper I had you firmly fixed in my mind as a maker of planers. I am sorry I did not know you made shapers, for, while I have a good tool, I always liked your planers best in the market, and perhaps I would have had the same opinion of your shapers."

But perhaps the most provoking manifestation of the peculiarity of these sure-you-never-make any-change kind of men, is their belief that you never make any improvements in the articles you manufacture. They have used a tool for a good many years, and are convinced that that is your standard, and the first thing you know they will buy one of another make, because it has features which your old one did not have, while, as a matter of fact, these improvements were perhaps originated by you, and are embodied in your present machines.

As I have intimated, these men in other respects are sensible, oftentimes being good mechanics and good manufacturers. The trouble is due chiefly to thoughtlessness or carelessness, and so I would urge your younger readers in particular to form the habit of looking over the entire field when they desire to be posted, or to make purchases. I beg that they may not compare an old catalogue of one maker with the new one of another, or, under similar circumstances, an old tool with a new one. All

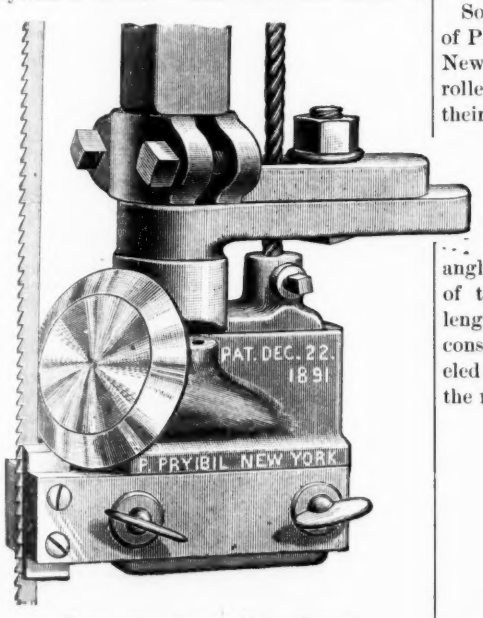
dealers or manufacturers in the same line should have an equal show, and particular pains should be taken to give a man who has already served you a full opportunity to display his wares. If he was foremost in the past, the chances are that he still maintains his relative superiority. P.

The Trolley System.

Editor American Machinist:

I notice in your issue of the 2d a would-be authoritative criticism of the overhead trolley system of electric railways from some one who hides behind the initials J. H. The article in question is hardly worth discussion, because of the evident lack of knowledge of the subject manifested by the self-appointed critic. There is a single question I wish to ask J. H. to answer, however, and which will disclose a lamentable ignorance or willful desire to misrepresent on his part. In what cities, and in how many instances, Mr. J. H., can you mention any accident resulting in loss of human life by the current used on a trolley wire?

It is a matter of record that there has not been a single death by shock from an electric railway wire of any description, except that of horses or other inferior animals. J. H. states, with a very brave show of authenticity, "That it [the trolley] is dangerous there is no room for question. There is danger to firemen and to people who pass along the streets, *as has been demonstrated*, notably, by the increase in accidents in cities where the system is in use." The italics are mine. I



IMPROVED BAND SAW GUIDE.

challenge J. H. to mention one single instance of loss of human life due to the street railway trolley system, which would not have inevitably occurred with any other system of rapid transit—the cable, steam dummy, or anything similar. In conclusion, I beg to say that I am not in any degree interested in any street railway system, and it would not affect me to the extent of one dollar if there was not a trolley wire on earth, but it is naturally disgusting to one in position to get at facts to hear them misstated, misrepresented, or willfully distorted by people who, as is evidenced by their criticisms, are either grossly ignorant on the subject or deliberately malicious.

CECIL P. POOLE,
Electrical Engineer.

Hardening Steel.

Editor American Machinist:

In answer to M., Question 220, issue May 19th, I have found very good results in hardening steel by heating it in a lead bath, thereby getting a very even heat, and then dipping it in a solution of urine and salt, one pound to the gallon. Then draw the temper by color until it suits the work; keep the solution about 40° F., if possible.

G. P. C.

Pipe Wrench—Wire Cutter.

We present herewith illustrations of two new tools recently brought out by the Billings & Spencer Co., of Hartford, Conn., the first of these being a pipe wrench, which, as the engraving shows, is so formed as to combine compactness and strength with convenience of operation.

The wrench is composed of two drop forgings of solid steel, the jaw being of best tool steel, while the handle is machinery steel.

An especial claim made for the wrench is that the angle of the opening of the jaws is always the same, whether it is being used on small or large pipe. The total length of the wrench is 14″, and it takes pipe from ¼″ to 1½″.

The wire cutter is also drop-forged, of best tool steel, and is provided with four cutting edges on the rim, besides two which are inclosed.

An adjustable gauge is attached, by which uniform lengths can be cut, and there are springs which relieve the hand in opening, and always bring the jaws into position for receiving wire. Total length of the tool, 10″.

PIPE WRENCH.

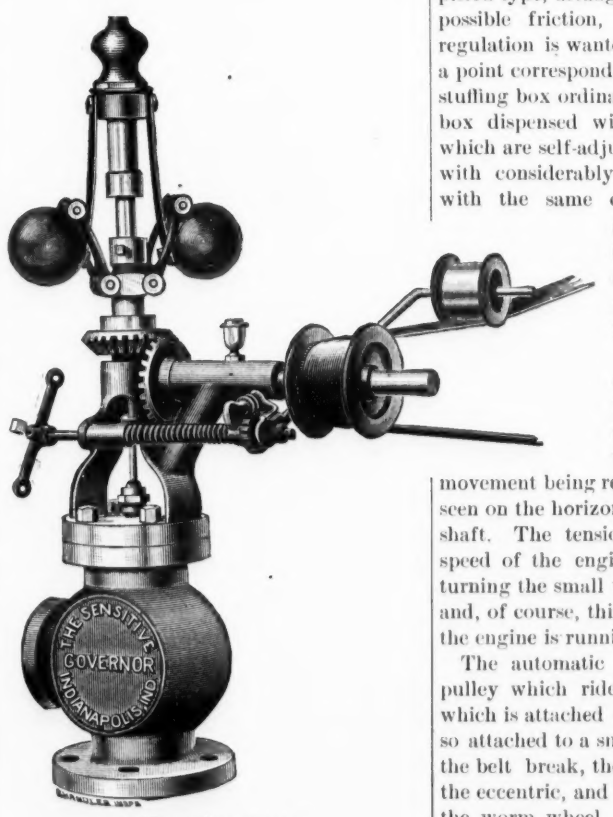
WIRE CUTTER.

Improved Band Saw Guide.

Some time ago during a visit to the shops of P. Pryibil, 498–510 West Forty-first street, New York City, the writer noticed a new roller guide for band saws in use on one of their machines, which was so novel and was working so nicely as to attract attention. We present herewith an illustration of the guide, by which it will be seen it consists simply of a roller, the axis of whose rotation is at such an angle to the saw blade that the back edge of the blade has a bearing of considerable length upon the beveled edge of the roller, a considerable portion of the width of this beveled surface being also covered by the blade, the result being that the hardened roller is comparatively little worn, no narrow groove being formed as is the case when the roller is mounted in the usual way. This, with the improved side guides below the roller, of course results in an improved action of the saw in many ways, especially with respect to breakages and twisting or "running." The roller is made in a single piece with the shank or spindle upon which it runs, and which is placed in a bearing closed at the bottom to prevent the escape of oil which can therefore be supplied abundantly without annoyance.

The side guides are also of hardened steel, wide and long to hold the saw securely and give durability, while they are also adjustable in any way, including an angular adjustment to compensate for wear at their front edges. The guide is readily put onto any machine, and when in place can be adjusted to suit saws of any width or thickness without the use of wrenches or screw-drivers.

It is made in two sizes—the smaller for saws up to 1″ wide, the larger for saws up to 2″ in width.



A NEW GOVERNOR.

A New Governor.

At the time of the formation of the combination of governor manufacturers, the men who are making the governor which we herewith illustrate were making a small engine, and finding the prices of governors considerably advanced as a result of the combination, they began to think of making a governor of their own, and for use on their own engines only. The result is the subject of the present description—a governor which, being put into use, has created a demand for itself, and is now furnished for the market in various sizes from ½″ to 8″.

As will be seen, the governor is of the fly-ball type, the balls being attached to flat springs and yokes in such a way that their path in moving outwards is practically a straight line. The yokes are attached to a collar, which is driven by the bevel gears seen, the arrangement being such that there is very little friction opposed to the movement of the balls, and they move with a promptness and certainty that justifies the name given the governor—"Sensitive."

The valve is of the balanced, double-ported piston type, arranged to move with the least possible friction, and where special close regulation is wanted, the stem is enlarged at a point corresponding to the location of the stuffing box ordinarily used, and the stuffing box dispensed with, spring packing rings which are self-adjusting, and move not only with considerably less friction, but always with the same or very nearly the same amount of friction, being substituted, which, of course, is an important point where the closest regulation is desired.

The outward movement of the balls pulls down the upper sleeve to which the springs are attached, and with it the valve stem, this movement being resisted by the spiral springs seen on the horizontal shaft below the pulley shaft. The tension, and consequently the speed of the engine, is changed by merely turning the small worm at end of this shaft, and, of course, this can be done as well when the engine is running as when standing.

The automatic safety stop consists of a pulley which rides the governor belt, and which is attached to a lever which in turn is so attached to a small eccentric, that, should the belt break, the pulley in falling rotates the eccentric, and disengages the worm from the worm wheel, and the spring instantly closes the valve. There are two of the spiral springs, one wound within the coils of the other, and their ends attached to opposite sides of the sleeve, so as to balance each other and relieve friction. The sawyer's lever seen at the left is put on simply as a concession to custom, or possibly prejudice. The governor controls the engine perfectly without it, and as a matter of fact its use is soon discontinued after the governor is put into service.

A ready test of the action of the governor is made by simply pressing the stem downwards by hand to about its mid position, and then striking one of the balls; they will continue to vibrate in and out for some time until finally brought to rest, thus showing the greatest freedom of action. The governor works equally well in a vertical, horizontal, or any other position.

It is manufactured by the Sensitive Governor Company, 113 to 125 S. Tennessee street, Indianapolis, Ind.

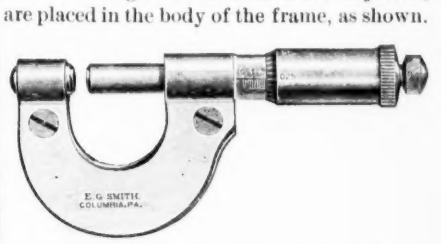
The experiment of pumping water into a hot dry boiler was recently tried out in Indiana. The result was an explosion by which four men were killed.

A boy of 14 riding on a railroad train in Pennsylvania caught hold of the branch of a tree through the open window, and was drawn through the window and severely, if not fatally, injured.

Micrometer Caliper.

The accompanying illustration is of a micrometer caliper, which is made in two sizes—half-inch and one-inch—by Mr. E. G Smith, Columbia, Pa.

The special features of the tool are, that both frame and screw are made considerably heavier than usual; the frame is split inside, or below the screw only, in order to lessen the liability of trouble from dirt getting into the screw. The clamping screw, by which the measuring screw and anvil are adjusted, are placed in the body of the frame, as shown.



The anvil has no threads cut upon it, and does not screw into the frame, but fits into a plain hole, into which it is clamped by the screw sufficiently to hold it for all fair usage, but so that it may slip if the measuring screw be in any way forced too hard, thus relieving the caliper and avoiding injurious strain.

The small knurled button at the end of the screw is used to facilitate the movement through considerable distances.

The manufacturer makes a specialty of furnishing any desired parts of the caliper, finished or rough, so that the tool may be completed, if desired, by the purchaser.

A Launch Run by Electric Power.

A trial trip of the new electric storage battery launch Electra took place on the Passaic River last Saturday. The result was highly satisfactory. The launch was built by the Electric Launch and Navigation Company of this city on lines laid down by C. D. Mosher and William Gardner, and was launched at Bay Ridge on May 14. In appearance the launch is similar to the Norwood. The power comes from seventy-eight cells of secondary battery, and the motor is 12 horse-power.

The launch is built of Spanish cedar, and polished. She is 34 feet long and 6 feet wide, with a draught of 23 inches. She will be sent to Chicago, and be used as a sample boat at the World's Fair.

Designer Mosher expects to create a sensation with a wonderful quadruple expansion engine for a boat which Lysander Wright is now building. Every part of the engine which can consistently be made hollow is to be bored out of the solid steel, for the purpose of obtaining lightness combined with strength. The engine will develop 600 horse-power.—*The Sun*.

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J. G. A. MEYER, } Associates.
FRED J. MILLER, }

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, JUNE 16, 1892.

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The San Francisco Meeting of the Mechanical Engineers.

The degree of success attending the recent meeting of the American Society of Mechanical Engineers, at San Francisco, may be estimated in various ways.

If it were to be considered solely upon the basis of attendance of members it could not of course be counted a very highly successful convention, for out of a membership of over 1,400, less than fifty members actually attended, which seems like a very small attendance, though when compared with the usual attendance of about 100, it does not seem so small.

But we do not think the success of the meeting should be estimated upon that basis alone, for there are other things to be considered. The society is not a local one; it is not the Eastern or the Central or the Southern Society of Mechanical Engineers, but the American Society, in which all mechanical engineers in the country, no matter whether located in Maine, Texas or California, are supposed, and, in fact, invited to take an interest, and become members.

Now having a membership scattered all over the country, and hoping to draw a still larger membership from all parts, the question arises how best to serve their interests in regard to the place of holding meetings.

If it were a matter simply of minimizing travel to and from the conventions, the place of holding them would be determined something as the "center of population" is determined from the census returns, and the meetings would then all be held, say at Pittsburg, or at Baltimore, or, possibly, New York.

But it is morally certain that such an arrangement would not suit the majority of members so well as the present arrangement, nor would it be so fair to the membership at large, for it would entirely relieve some of them of the necessity of traveling to and from the meetings, while others would invariably have to travel thousands of miles to attend, and all of them would see the very same city or section of country each time, without the opportunity for studying the engineering of the country generally, which the present plan affords, and which is so beneficial to an engineer.

It is observed that a meeting held in a section of country previously unvisited always results in a considerable accession of membership from that section. It is quite certain that San Francisco will be no exception to this rule, and that some valuable names will be added to the roll as a result of the meeting there—names of men who can, and probably will, by professional papers and otherwise, give to other members of the society much that will be of great value to them.

Of course it cannot be that meetings will be held as often in remote places as nearer the industrial centers, where the bulk of the membership is found, but there can be no question but that the entire territory from which members have been, and are to be drawn, should be covered by the meetings, the fall meetings—always held in New York—being a fair concession apparently to the minimum travel theory, and this made fair only by the fact that most engineers want to—and, in fact, must—visit New York occasionally, because it is the engineering as well as the commercial center.

It will probably be many years before the society will again go so far as the Pacific Coast, but, if it should go again, it is probable that improvements could be suggested in the itinerary, it seeming rather strange that a body of engineers should pass through or very near to such places as Denver, Pueblo, and Virginia City without visiting them. The failure to see these places must be attributed to the fact that the schedule was arranged almost solely by excursion agents, who are in the habit of arranging them for the ordinary tourist wishing to see only the regular wonders mentioned in guide books. Such a new schedule would almost inevitably involve more time, however, for it is safe to say that no feature of the recent trip would be willingly sacrificed—certainly not by the advice of those who were members of the recent party.

If it should so happen that a meeting should be held at, say Denver, within a year or two, many points of great interest to engineers, which were missed on the recent trip, could be visited, it being understood that next spring's meeting is to be at Chicago.

Most of the members of the society are, of course, busy men, and find it impossible to take the time necessary for such extended trips as the recent one, but such trips do not occur often, and there are, we think, many excellent reasons for taking them occasionally.

The combination of the anthracite coal roads has not yet reached smooth sailing it seems, nor does it seem likely to for some time to come, since the prosecuting attorneys of two States are moving against it, urged on by citizens, some of whom are acting in their private capacity, while others act as stockholders of one or the other of the companies concerned.

And it reminds one of the familiar saying, "Whom the gods would destroy they first make mad," to see how the combine is carrying on its business. It first began by bragging on the large proportion of the anthracite production it was able to control, bidding defiance to independent operators and the public, and it is now following this by increasing the price of coal without any apparent reason except that it is in a position to increase it, and the people apparently cannot help themselves. The courts may possibly decide that the combination is illegal and void, but whether they do or not, there can be no reasonable doubt but that such performances as this will some day be effectually squelched by the people in some way. Americans are a patient and long-suffering people, but there is, we still believe, a limit to their patience, and he who has any regard for his health or the success of his schemes will not try them too far.

The engineers visiting San Francisco were again reminded that human nature is much the same everywhere, by the performance of a railroad company or a company intimately connected with a railroad company in preparing to fight for the possession of a water front in Oakland, armed bodies of men having been stationed to guard the disputed property, and to drive piles or prevent their being driven, each side declaring that blood would be freely shed if necessary to maintain its rights.

Now this, of course, is nothing more nor less than anarchy, and not merely philosophic anarchy either, but violent and aggressive anarchy, and an example and incentive to others to settle their differences by force, and without appeal to justice or the properly constituted authorities. These men who are at the head of the respective companies are of course men of property; but a resort to force to gain more property is no less anarchy than the resort to force to gain the first dollar's worth of it, and it would seem as though men who had property rights worth protecting would think twice before setting an example of lawlessness, which, when carried to its logical conclusion, disregards all property rights, and, in fact, all rights but those secured by brute force.

It has been the custom to send a few of the brightest graduates of Annapolis abroad at the completion of their studies there, to study in foreign navy and ship yards the science and practice of naval construction, many of the foreign navy yards being open to Americans for this purpose But it is now announced that this is to be changed, and that all the American naval constructors may be able to learn of the practice in foreign navy yards from this time on must be learned by peeping through the cracks in the fence, so to speak. On some accounts this is to be regretted, we suppose, but yet we shall get along no doubt in some way, but it would seem as though our own navy yards, and other establishments where naval vessels are being built, should not be quite so easily accessible to foreigners, and that the draftsmen and others employed in them should at least be American citizens, which, it is charged, they often are not.

Some time ago we noted the fact that there was a contest under way between the city government and people of Cleveland, O., on the one side, and the local gas company on the other, the city authorities having passed an ordinance reducing the price of gas to 60 cents per thousand, an ordinance which the gas company was vigorously fighting. During the contest which has been going on, it is claimed that it has been conclusively proven that 60 cents would afford a fair profit to the company, but nevertheless a compromise has been effected by which the price is fixed at 80 cents per thousand, and the company is to pay into the city treasury 6½ per cent. of its gross receipts for gas, besides paying all the expenses of the litigation. This, of course, is a great victory for the people against a monopoly, and is so regarded. The saving to the people will be about $140,000 per year, and to the city about $20,000, aside from the percentage.

Literary Notes.

ROCKS IN BUSINESS LIFE. Second edition.

This is a finely printed little pamphlet, the matter of which is composed of an address by Mr. C. M. Hobbs before the Young Men's Christian Association of Denver, Colorado. There is a great deal of good advice in this little book to young men who are starting out in life, and, in fact, to all men who have a praiseworthy ambition to advance themselves, or, as the author puts it, "get on in the world." Mr. Hobbs is purchasing agent of the Denver & Rio Grande Railroad, and he evidently writes or speaks from extended observation and strong conviction.

By inclosing a two-cent stamp for postage to the association previously named, this pamphlet, furnished with an attractive cover, will be sent free to any address.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(250) C. B. P., Chicago, Ill., writes: Kindly inform me how the engineers and draftsmen employed by the U. S. government and cities obtain their positions, or where can I obtain information on this subject? *A.*—They obtain their positions by applying for them as they would do for any position in a private establishment. We see no other way of acquiring the information you seek than by making applications yourself at the various departments.

(251) A. M., West Hoboken, N. J., writes: Kindly let me know the prices of the following named books: Elementary Geometry, by Prof. E. Olney; Elements of Natural Philosophy, by E. M. Avery; Theoretical Mechanics, by J. E. Taylor; Principles of Elementary Mechanics, by Prof. De Volson Wood; and Strength of Materials and Structures, by J. Anderson. *A.*—In answer to Question 380, in our issue of Aug. 20, 1891, we have given the names of publishers of these books. Write to these, or to any first-class dealer in scientific works, for the prices. We do not sell books.

(252) I. W. S., Providence, R. I., writes: Within a certain mechanism there is a ring about 14 inches diameter and 2 inches wide, except in one place where it is widened to admit boring threading for a piece 4 inches diameter. This piece is itself a short cylinder with a narrow cross-piece carrying a boss in the center, and answers two purposes: one to compress the packing close to its circumference, the other to guide a small piston passing through its boss. What is the proper mechanical term of said piece? Is the term "external nut" an absurdity? *A.*—The term "external nut" is not an absurdity, but it is not an appropriate term. In order to give it the right name we must know in what connection with other pieces it is used, and its purpose.

(253) A. S. S., Wilkes-Barre, Pa., writes: Will you kindly explain in your Question and Answer columns, why some authorities give the formula for the deflection of an I beam loaded at the center:

$$D = 36\,\frac{W\,l^3}{E\,I},$$

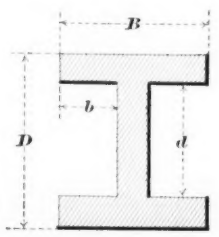
and others give

$$D = \frac{W\,l^3}{48\,E\,I}$$

in which D = deflection in inches; W = load in pounds; l = span in feet; E = modulus of elasticity; and I moment of inertia of section

$$= \frac{B\,D^3 - 2\,b\,d^3}{12}; \text{ see sketch.}$$

A.—In the first formula the length l is taken in feet; in the second formula the same



length is taken in inches. In finding the moment of inertia, the dimensions of the section are taken in inches for both formulas. Under these conditions the same result will be obtained with either formula.

(254) C. E. K., Watertown, N. Y., writes: Inclosed please find sketch of a lever with a bearing on each side. Kindly give formulas for designing a lever of this kind when the force applied at one end is given. I have several good books, but they do not give full directions for laying out a lever of this kind. I think full directions for designing such would be appreciated by the mechanics who read your Question and Answer columns. The length of the lever, position of fulcrum is given, and the force applied at one end, and that transmitted at the other is also given in the sketch. What is wanted is how to determine all the dimensions of the lever, size of pins, and the shearing stress on them. I am aware that the above request will require considerable of your valuable time and space in your columns, but I feel sure that others beside myself will thank you for publishing such useful information. A.—For simplicity, we will assume that the lever is perfectly plain, that is, without hubs or holes; this reduces the lever to a simple beam supported at the ends with a concentrated load between the supports. We further simplify the subject by considering the portions of the lever lying on each side of the center line $x\ y$ separately. Let us consider the portion lying to the right of $x\ y$. Here then we have a simple beam 24 inches long, firmly fixed at $x\ y$, with a load of 2,600 pounds at the other end. The effect of this force is measured by its bending moment, which is equal to the product of the load multiplied by its arm l; denoting the load by W and the length of arm in inches by l, we have

bending moment $= W \times l$

$= 2{,}600 \times 24 = 62{,}400$ inch-pounds.

The load W maintains its equilibrium by means of the internal stresses which are generated in the beam. The moment of these stresses, called the resisting moment, is equal to $\frac{S \times I}{c}$, in which S denotes the stress per square inch on the fiber most remote from the neutral surface, and c, the distance in inches from the neutral surface to the most remote fiber; I, the moment of inertia. The expression $\frac{S \times I}{c}$ holds good for any form of cross-section, whether it be rectangular, square, round, or T-form, etc.; but it must be remembered that the value of I changes for the different forms of cross-section. Now since for equilibrium the bending moment must be equal to the resisting moment, we have

$$W \times l = \frac{S \times I}{c}. \qquad (1)$$

The cross-section of the lever is to be rectangular; for a section of this kind the moment of inertia I is equal to $\frac{b\,d^3}{12}$; and c is equal to $\frac{1}{2}\,d$, in which b denotes the breadth of the lever, and d its depths, all in inches; hence formula (1) becomes

$$W \times l = \frac{S \times b \times d^3}{12 \times \frac{1}{2}\,d} = \frac{S \times b \times d^2}{6}. \qquad (2)$$

For wrought-iron the value of S is generally taken at 12,000 pounds; substituting this value for S in formula (2) we get

$$W \times l = 2{,}000 \times b \times d^2 \qquad (3)$$

From this formula we can easily find the breadth b when the depth d is known, or d when b is known. The ratio between the depth and breadth is arbitrary; let us decide to make $b = \frac{3}{4}$ inch, then, according to formula (3), we have

$$2{,}600 \times 24 = 2{,}000 \times .75 \times d^2$$

$$62{,}400 = 1{,}500 \times d^2$$

hence $\frac{62{,}400}{1{,}500} = d^2 = 41.6.$

The square root of 41.6 is 6.44, say $6\frac{1}{2}$ inches, for the depth d of lever at the section through $x\ y$. The depth at the end of the lever should be equal to one-half of the depth at $x\ y$; hence at the end the lever will be $3\frac{1}{4}$ inches deep, and the same depth will be required at the opposite end. The shearing stress on the pin N is equal to the sum of the forces acting at the ends of the lever plus its weight, the latter we shall neglect; hence we have 2,600 + 10,400 = 13,000 pounds for the shearing stress on two sections of the pin; therefore one section will have to resist 6,500 pounds. For safety we may allow a shearing stress of 10,000 pounds per square inch; this gives us $\frac{6{,}500}{10{,}000}$ = .65 square inches for cross section of the pin, the corresponding diameter is $\frac{15}{16}$ inch nearly. But generally in practice we have to increase this diameter so as to reduce the wear in the bearings, or prevent heating. In many cases we should not have a greater pressure than 1,500 pounds per square inch of projected area; frequently this pressure has to be less; let us, however, assume that the pressure must not exceed 1,500 pounds, and that the diameter of the pin and the length a of the bearing are to be equal to each other. The total pressure on the end or journal N of the pin we have found to be 6,500 pounds; hence its projected area (which is equal to the length a multiplied by the diameter) is equal to $\frac{6{,}500}{1{,}500} = 4.33$ square inches; now since the length a is to be equal to the diameter, we have $\sqrt{4.33} = 2.08$, say 2 inches for the diameter of the pin; but drilling a 2-inch hole through the lever will weaken it to some extent; this loss of strength must be made up by the hub; we have therefore now to find the breadth B of the hub. To find this breadth we again apply formula (1), but now we have to deal with a cross-section at $x\ y$ like that shown in Fig. 2. The moment of inertia I of a cross-section of this form is $\frac{B\,(H^3 - h^3)}{12}$, and the value of c in formula (1) is now $\frac{1}{2}\,H$; hence formula (1) takes the following form:

$$W \times l = \frac{S \times B \times (H^3 - h^3)}{12 \times \frac{1}{2}\,H}; \qquad (4)$$

adopting again a value 12,000 for S formula (4) reduces to

$$W \times l = \frac{2{,}000 \times B \times (H^3 - h^3)}{H};$$

substituting the numerical values for the symbols, and remembering that $H = 6\frac{1}{2}$ inches, and $h = 2$ inches, we have

$$2{,}600 \times 24 = \frac{2{,}000 \times B \times (6.5^3 - 2^3)}{6.5}$$

$$62{,}400 = 82{,}038 \times B,$$

which gives

$$B = \frac{62{,}400}{82{,}038} = .76 \text{ inch},$$

which shows that the thickness of the lever has to be increased only to very slight extent to make up for the loss of strength by drilling the hole through the lever, it practically gives no depth for the hub. So far, mathematics has aided us in finding dimensions to meet the requirements of strength,

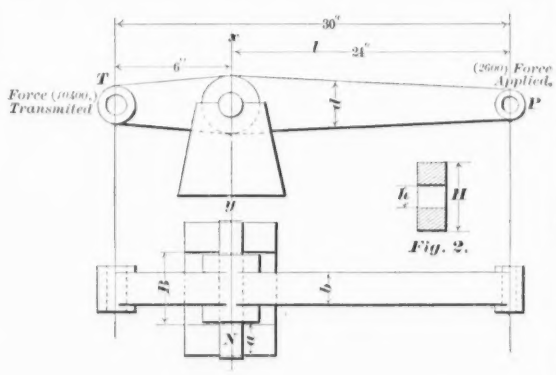


Fig. 2.

now we must satisfy practical requirements, and these can be made provided we do not interfere with the strength. If the lever is to be keyed to the pin N we need a hub on the lever, the breadth of the hub may be made from one to twice the diameter of the pin as experience and good judgment may dictate. From the foregoing we also conclude that for strength the breadth of the hub at the end of the lever need not be much greater than the thickness of the lever. Practical considerations generally limit the size of pins at the ends. If the pin in the long arm is loose, and we decide that the pressure per square inch of projected area shall not exceed 1,500 pounds, and that the diameter of the pin shall be equal to the width of hub, then, remembering that a force of 2,600 pounds is acting on this end, we have $\frac{2{,}600}{1{,}500} = 1.73$ square inches for the projected area, and $\sqrt{1.73} = 1.31$ inches for the diameter of the pin and width of hub. At the other end of the lever we have a force of 10,400 pounds acting upon it, and if the pin in this end is also loose, and the pressure per square inch is not to exceed 1,500 pounds, then we have $\frac{10{,}400}{1{,}500} = 6.93$ square inches for the projected area of the pin in the hub; if the breadth of the latter is to be 4 inches, then the diameter of the pin will have to be $\frac{6.93}{4} = 1.73$ inches.

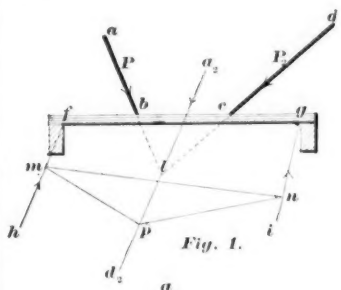


Fig. 1.

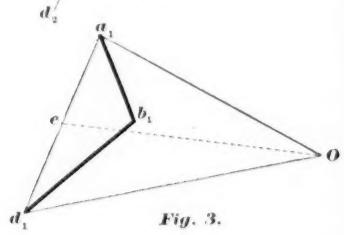


Fig. 3.

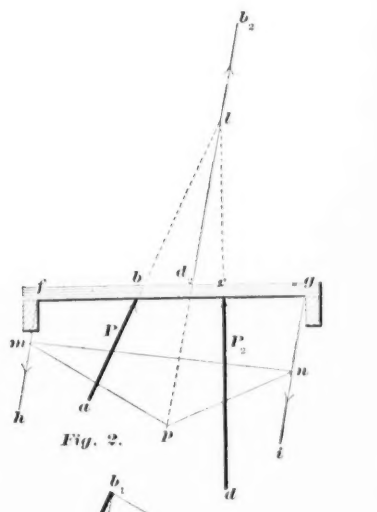


Fig. 2.

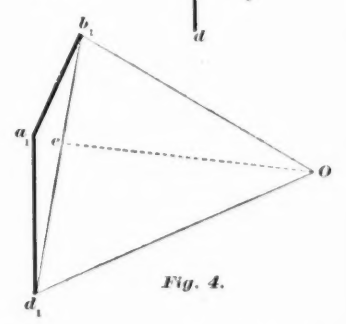


Fig. 4.

(255) X. Y., ——, writes: Please inform me how I can find graphically the resultant of two forces P and P_2, acting on a beam as shown in Fig. 1, and the reactions at the points of support. Also how do you find the resultant of the two forces P and P_2, shown in Fig. 2, and the reactions at the point of supports? A.—For these constructions choose any scale for laying off the length of lines which represent the forces; but whatever scale has been adopted must be used throughout the whole construction. On $a\ b$, Fig. 1, lay off a length to represent the magnitude of the force P, and on $c\ d$ lay off a length to represent the magnitude of the force P_2; prolong these lines to meet in the point l; through this point the resultant must pass. Anywhere in Fig. 3 draw $a_1\ b_1$ parallel to $a\ b$, and make the length of the former equal to that of the latter. From the point b_1 draw a line $b_1\ d_1$ parallel to $c\ d$; these two must also be equal in length. Join a_1 and d_1 by a straight line, then $a_1\ d_1$ will be the resultant of the two given forces; the length of $a_1\ b_1$ measured with the adopted scale will give its magnitude, and the direction in which the line $a_1\ d_1$ is drawn also shows the direction in which the resultant acts. Through l, in Fig. 1, draw $a_2\ d_2$ parallel to $a_1\ d_1$, and make them equal in length; this places the resultant in the correct position, and it will have the same effect on the beam as the combined effects of the forces P and P_2; in fact, the resultant $a_2\ d_2$ replaces the two given forces. To find the reactions of the supports, draw through the inner edges f and g of the supports the lines $f\ h$ and $g\ i$ parallel to the resultant $a_2\ d_2$; this gives the directions of the reactions. Our next step will be to find their magnitudes. Select any point O in Fig. 3; through O and a_1 draw a straight line; also through O and d_1 draw a straight line. In Fig. 1, take any point m on $f\ h$, and through it draw a line $m\ p$ parallel to $a_1\ O$, cutting the resultant in the point p; through p draw a line $p\ a$ parallel to $d_1\ O$, cutting $g\ i$ in the point n. Join m and n by a straight line. Through O, in Fig. 3, draw $O\ e$ parallel to $m\ n$, cutting $a_1\ d_1$ in the point e; then $a_1\ e$ will represent the magnitude of the reaction $f\ h$, and $e\ d_1$ will represent the magnitude of the reaction $g\ i$. The construction of Figs. 2 and 4 is similar to that of Figs. 1 and 3; the position of the letters is such as to make the foregoing explanation applicable in this case. The result of the construction is that $b_2\ d_2$ drawn through the point l, parallel to $b_1\ d_1$, and both equal in length, gives the required resultant; $f\ h$ parallel and equal in length to $e\ b_1$ gives the reaction of the left support; and $g\ i$, parallel and equal in length to $e\ d_1$, gives the reaction of the right support. Of course it is assumed that all the forces act in each construction in one plane.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago. See Randall's new Adv., page 11.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

S. A. Smith 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

"Boiler Tests by Barrus." Get sample pages from Gowing & Co., Mason Building, Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., cor. Canal and Washington Sts., Chicago, Ill.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

25", 32", 37", 42" — "Only Drill Press built on 'Ko-rekt' principles, Even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

Patent Soliciting of High Class. D. Walter Brown, Counsel in Patent Cases. 31 Nassau Street, New York. Send for Brief History of Patent Legislation.

Just Pub.—Safety Valves, History, Invention & Calculation. By W. B. LeVan. Fully ill. $2. Cat. of Machinists', Electricians' & Engineers' books sent free. N. W. Henley & Co., 150 Nassau St., N. Y.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886 issue; must be unsoiled, and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Just Published: "Ways & Means" for Machinists & Metal Workers. A new work, thoroughly practical, containing new matter that no inteligent mechanic should miss. The cheapest work ever issued, 160 pp., 150 illustrations, including working details of the latest mach. tool design & prac. Cloth. Price $1. John W. Weston, Pub. Journal of the Association of Eng. Societies, 78 La Salle St., Chicago.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Graphic Diagrams.

BY M. E.

In the AMERICAN MACHINIST for April 14, 1892, the writer gave directions for the construction of a graphic diagram of the strength of riveted joints, from which the percentage of strength of the rivets compared with the solid plate could be readily determined. In the present supplementary paper two diagrams are given, of which Fig. I is also in connection with riveted joints, giving curves of percentage of strength of plate at a joint, compared with the solid plate. As will be

seen from the diagram in question, two lines $A\,B$, $A\,C$, of convenient length are drawn at right angles to form the "asymptotes" of the series of rectangular hyperbolas which constitute the curves of strength percentage. The line $A\,B$ is spaced out in divisions, representing the maximum pitch of the rivets in inches. These divisions extend so as to embrace a pitch of 8 inches (although this is, of course, a purely arbitrary limit), and are subdivided into $\frac{1}{4}$-inch divisions as shown. Upon the line $A\,C$ is also laid off a number of equal spaces representing percentages of plate strength, being figured as indicated and subdivided to any desirable extent. It is unnecessary to carry these divisions below say the 20 per cent. horizontal, and as nothing above 90 per cent. is required in practice it is convenient to limit the actual working diagram to the portions shown in full lines.

Through the point n in which the line $D\,E$ figured 50 per cent., crosses the ordinate 1 P, a hyperbola $n.\ o.\ p.$ is drawn, and through E, the point of intersection of $D\,E$ and 3 T, a second hyperbola $x\ E\ H$ is drawn. The method of finding points in these curves has been explained in the former contribution; but it may not be out of place to briefly indicate the method of procedure. For the first curve join $P\,A$, cutting $D\,E$ in d, and through d draw the ordinate $R\,S$. Then to determine any other point on this curve draw a radial line from A as $A\,Q$, cutting $S\,R$ in g and $C\,K$ in Q. Draw the ordinate Q^2 and a horizontal $g\ o$ through g; the intersection of these two lines gives a point o in the curve required. Other points may be readily obtained in the same manner and the curve drawn through them. Similarly for the outer curve the ordinate 3 E is produced to T and A joined to T. Through the point t, in which $A\,T$ cuts $D\,E$, the ordinate $x\,y$ is drawn and points in the curve $x\ E\ H$ found as before. To obtain points in the intermediate curves it is only necessary to divide the length of the horizontals intercepted between the inner and outer curves as shown. Thus $n\ E$ is first divided into eight equal parts, and each of the other horizontal intercepts, as $o\ a$, is divided in a precisely similar manner, curves being drawn through the points thus obtained. It is convenient to afterwards subdivide the first five of these divisions in order to obtain the curves representing rivet diameters of $\frac{9}{16}$, $\frac{11}{16}$, $\frac{13}{16}$, $\frac{15}{16}$, and $1\frac{1}{16}$ inches as shown.

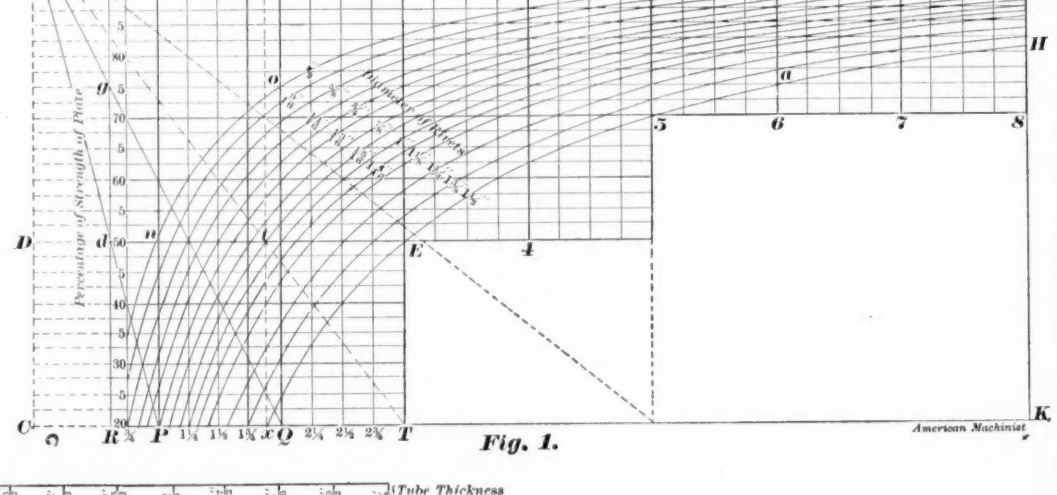


Fig. 1.

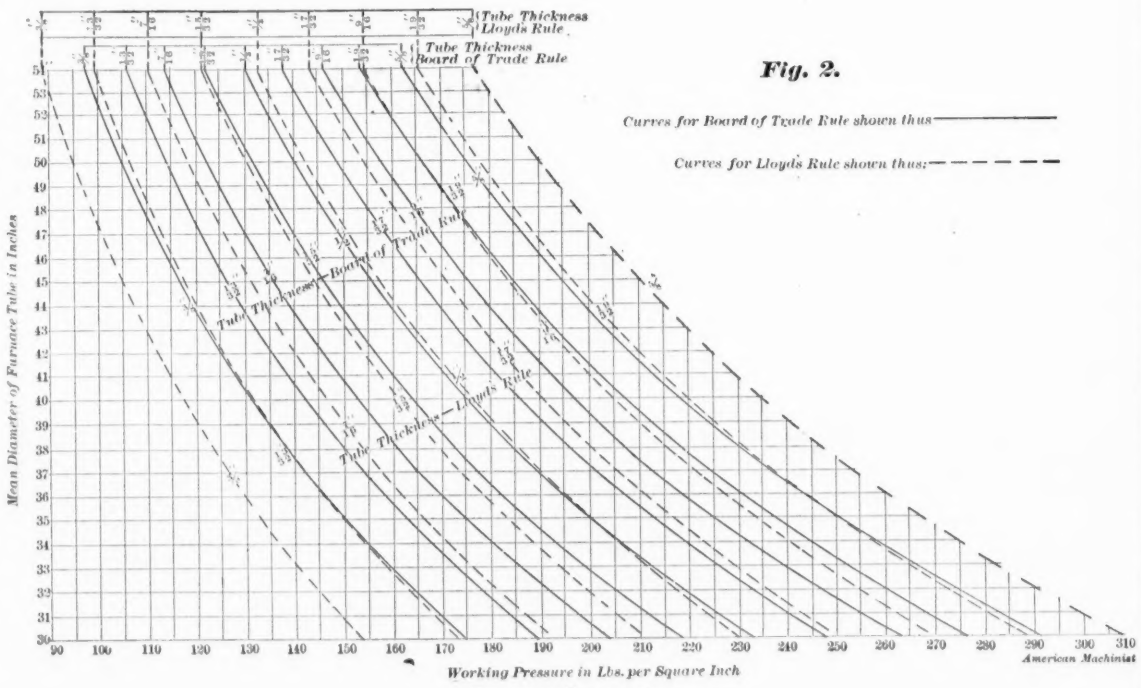

Tube Thickness Lloyds Rule
Tube Thickness Board of Trade Rule
Curves for Board of Trade Rule shown thus
Curves for Lloyds Rule shown thus:
Mean Diameter of Furnace Tube in Inches
Working Pressure in Lbs. per Square Inch
American Machinist

Fig. 2.

GRAPHIC DIAGRAMS.

In using the diagram it is only necessary to follow the ordinate representing the maximum pitch until it cuts the curve of rivet diameter; the horizontal through this point then gives the percentage of strength of plate on the vertical scale.

The diagram, Fig. 2, will, it is thought, prove of service in connection with marine boiler work, as it gives the working pressures allowed by the British Board of Trade and by Lloyd's rules for corrugated furnace tubes, now so largely used for marine boiler furnaces. The corrugations in these tubes are semi-circular in form, and symmetrical, the length from crest to crest being about 6 inches, and the total depth of the corrugation 2 inches; so that there is a difference of 4 inches between the inner and outer diameters. By the Board of Trade rule the allowable working pressure is given by the formula

$$P = \frac{14{,}000 \times T}{D},$$

in which P = working pressure in pounds per square inch.

T = thickness of tube in inches.

D = mean diameter of tube in inches.

Lloyds' formula gives somewhat different results, and is as follows:

$$P = \frac{1{,}234 \times (T - 2)}{D}.$$

In this case P = working pressure in pounds per square inch.

T = thickness of tube in sixteenths of an inch.

D = greatest diameter of tube in inches.

Although the construction lines are not shown in the diagram, as they would occupy too much space, the drawing of these curves should not present any difficulty after the explanation previously given. As will be seen, the base line is divided into a number of equal parts representing working pressures of from 90 to 310 pounds per square inch. The vertical "asymptote" of the curves is the ordinate at 0, which would be found by prolonging the base line to the left and continuing the spacing until the zero of the scale is reached. The divisions of the vertical scale represent tube diameters from 30 to 54 inches, and the horizontal "asymptote" for the Board of Trade curves is found by continuing the scale downwards until the zero (0) horizontal is reached. To obtain the horizontal asymptote for the Lloyd's curves, however, the scale must be extended *two divisions below zero*, since D in this case represents the *greatest* diameter, while the vertical scale is drawn for *mean* diameters only.

It will be noticed that the curves corresponding to the Board of Trade rule are drawn in full lines, and those representing Lloyd's formula in broken lines. As in the previous example, it is only necessary to draw the inner and outer curves of each set, the intermediate curves being obtained by dividing the several horizontal intercepts into 8 equal parts. The points on the 54-inch horizontal through which the curves are drawn may be readily found by the formula given above. Thus for the $\frac{8}{8}$ inch Board of Trade curve the starting point is at $\frac{14{,}000 \times \frac{8}{8}}{54} =$ 97.4 pounds measured on the 54 inch horizontal, while for the $\frac{8}{8}$-inch curve it is

$$\frac{14{,}000 \times \frac{8}{8}}{54} = 162 \text{ pounds.}$$

Similarly for Lloyd's rule the $\frac{8}{8}$-inch curve commences at $\frac{1{,}234 \times (6 - 2)}{54 + 2} = 88.1$ pounds, and for the $\frac{8}{8}$-inch curve the starting point is $\frac{1{,}234 \times (10 - 2)}{54 + 2} = 176.2$ pounds measured along the 54 inch horizontal in each case.

This is all that is necessary to locate the outer curves, and the others can then be interpolated as explained in the foregoing.

Death comes to men in various forms about industrial establishments, and at times in such ways as seem impossible to have foreseen or provided against. The engineer in the works of the T. New Roofing Company, of this city, is reported to have been killed by the breaking of a belt, which tore down some steam pipes, and these dragged the engineer, Mr. John Desmond, into the wheel pit, where he was crushed to death and horribly mutilated.

A correspondent is desirous of knowing who makes, for sale, the material fibroid used for making small gears.

MANUFACTURES

There is talk of a new tin-plate-mill in Scranton, Pa.

The St. Louis (Mo.) Car Company will enlarge its plant.

A $500,000 steel plant is contemplated for Youngstown, O.

G. B. Burnett & Sons will enlarge their hat shops at Amherst, Mass.

It is probable that the flint factory at Streator, Ill., will be enlarged.

New machinery will be placed in Bunnell's saw-mill at Windermere, Fla.

The Brownell & Wight Car Company is enlarging its plants at St. Louis, Mo.

The Matthews Cotton-mills Co., Selma, Ala., will put in additional machinery.

New machinery will be placed in the Brazil (Ind.) Brick and Pipe Company's plant.

The Gunflint Lake Iron Company is a new $100,000 concern at Port Arthur, Ont.

The Mobile (Ala.) Electric Lighting Co. will increase its capital stock $100,000.

W. J. Carter & Bro., Dublin, Ga., will double their foundry and machine shop's capacity.

J. P. Saunders and J R. Biggs will erect a foundry and machine shop at Bartwell, Ky.

The Reading Iron Company, of Reading, Pa., will erect a new pipe-mill 178x832 feet in size.

The Coffin Valve Company, of Boston, Mass., will erect a brick factory at Neponset, same State.

The Northwestern Railway Company will erect a large cold-storage warehouse at Appleton, Wis.

The Thomson-Houston Carbons Company's recently burned plant at Fremont, O., will be rebuilt.

New Orleans parties will establish machine shops and a foundry at Birmingham, Ala., to cost $100,000.

The Magnolia Cotton-mills Co. has been organized, to erect a cotton-mill at Magnolia, Miss. Capital, $100,000.

The Crucible Steel Works Company, at East St. Louis, Ill., has increased its capital stock from $75,000 to $300,000.

An addition 70x90 feet is being built to the rolling-mill of the Benedict & Burnham Mfg. Company, at Waterbury, Conn.

An electric mining plant will probably be adopted by the Southern Land Improvement Company's coal mines at Pineville, Ky.

The stockholders of the Lebanon Chain Works, Lebanon, Pa., have voted to increase the capital stock from $10,000 to $20,000.

A $40,000 machinery and boiler plant is to be established at Mansfield, O., by Jerry Sullivan, Philip Walters and William Herring.

The Electric Light Co. of Mobile, Ala., proposes to increase its capital stock and will enlarge its steam and electrical plants.

Wm. T. Harris, of Louisville, Ky., intends to erect in Baltimore, Md., a plant for making a gasoline motor for propelling vehicles.

Foster, Nightingale & Co. will rebuild at once the Mechanics Mill at Mechanics, Attleboro, Mass., which was burned last December.

The Wm. Powell Co., Cincinnati, Ohio, have just commenced building large works for the manufacture of their steam specialties.

The New Rome Street Railroad Co. has purchased for $25,000 the Rome (Ga.) electric light works, and will consolidate same with its power plant.

Joseph E. Johnston, William Berney and A. C. Howze have incorporated the Birmingham (Ala.) Cotton-mills, to erect a mill; capital stock, $50,000.

The Baltimore & Potomac Railroad Co. has obtained permit to erect a power house on the corner of Madison avenue and Wilson street, Baltimore, Md.

The Kempsmith Machine Tool Company, Milwaukee, Wis., has issued a circular illustrating and describing a plain milling machine recently brought out.

The Waterbury (Conn.) Brass Co. has awarded the contract for the new building to replace the one recently burned. Its dimensions are 150x350 feet.

The Short Duplex Engine Company will erect a new building at Carthage, N. Y. The structure will be utilized in the testing of the new Shortt brake.

Hoosick Falls, N. Y., has raised one-half of the amount required to secure a manufactory of steam road rollers, steam engines and centrifugal pumps.

The contracts are awarded for the erection of the large factories of the new General Electric Co., to be located on the bank of the Saugus River, near Lynn, Mass.

The Cleveland Cast-iron Pipe Works, of New Philadelphia, O., have been sold to J. B. Clow & Son, of Chicago, who will put the works in operation at once.

Messrs. Burr & Bailey, operating foundry, machine shop and copper works at Wilmington, Del., have incorporated as the Burr & Bailey Company, with a capital stock of $60,000.

We have received from the Albro-Clem Elevator Company, of Philadelphia, a photograph of a steel worm wheel of gun metal 66 inches diameter, 80 teeth, double thread, 5.182 inches pitch.

The West End Land Co., Birmingham, Ala., has contracted with New Orleans (La.) parties for the erection at West End of a $100,000 plant for the manufacture of heavy machinery of all kinds.

Ground has been broken at West Troy, N. Y., for the new plant of the Troy and Albany Malleable Iron Works, recently consolidated, and the entire business will be centered at this point, employing some 1,500 men.

The John A. White Company, Dover, N. H., has issued an "Engineer's Hand-book" of woodworking machinery. It contains a large number of cuts, with descriptions of the standard machine made at the works.

Edward W. Dawson, of New Haven, Conn., and Charles A. Benton, of New York, have incorporated the Victor Manufacturing Co., at Bessemer, Ala., to manufacture radiators, tools, machinery, etc. The capital stock is $200,000.

The plant of the Norristown Steel Company, at Norristown, Pa., is being enlarged by the addition of 200 feet to the main building. Two 20-ton electric cranes have been received, and will travel the entire length of the main structure.

The Automatic Weight Power Pump Co., Little Rock, Ark., recently chartered, has for president, A. D. Thomas; for vice-president, C. E. Rice, and for secretary, G. E. Cunningham. Its purpose is to manufacture the Thomas patent pump.

The Smith Cotton Hoe Co. has been organized, at Atlanta, Ga., to manufacture agricultural implements. The capital stock is $50,000. A specialty is made of the manufacture of the W. B. Smith patent cotton hoeing machinery and revolving disk bender.

The Skinner Chuck Co., New Britain, Conn., report larger sales the last month than in any month before. They write us that orders continue to come in for their improved lathe and drill chucks, and that more machinery is being put in to keep up with orders.

There is water-works agitation in Sprague, Wash.; Lake Charles, La.; Arlington, Ore.; Cambridge, Md.; Deadwood, S. D.; San Diego, Cal.; Ontario, Cal.; Preston, Pa.; Orange City, Ia.; Tracy, Minn; Westport, Mo.; Bedford, Ind.; South Berwick, Me.; Hanover, N. H.; Titusville, Fla.; Cleveland, Ohio; Ellisville, Miss.; and Wallace, Neb.

The following announcement explains itself: We have this day transferred our entire interest and good will heretofore claimed in all pulley lathes, as advertised and illustrated, to the Ohio Machine Tool Works, Wm. Lodge, proprietor, and respectfully recommend same to the general public. The Lodge & Davis Machine Tool Co., Charles Davis, president. May 27, 1892.

The Link Belt Engineering Company, Nicetown, Philadelphia, and 49 Dey street, New York, has issued a new catalogue of power transmission by manila rope. It contains much information on this subject, showing by cuts examples of transmission. Particular attention is called to improvement in multiple groove and separable sheaves, whereby greater lightness and strength are obtained.

The Dwyer Manufacturing Company, formerly of Ross Station, are building a large new iron foundry at Charles street and Railroad avenue, Seattle, Wash., where they will continue the manufacturing of soil pipe, fittings, and plumbers' goods. Many new patterns have been added, and the new works will have a much larger output than heretofore. The firm consists of P. V. Dwyer & Bros., and Geo. James.

The following extract is from a letter received by Robert Poole & Son Co., Baltimore, Md., from an English correspondent: "There has been a great inquiry going on for the last three months in the House of Commons, London, respecting the Leffel turbines destroying the salmon fry on the rivers. The government officials were prosecuting the mill owners. I think the latter will come off victorious yet, as I have passed live and dead fish through without a scratch on them. Another party put hard-boiled eggs through without being broken."

Machinists' Supplies and Iron.

NEW YORK, June 11, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15.75 to $16; No. 2, $14.75 to $15; Gray Forge, $13.75 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $14.25 to $15 for No. 2; and $13 to $13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is weaker.

We quote Hallett's, 11½c. to 11¼c.; Cookson's, 14½c.; and L. X., 12¾c. to 12⅞c.

Copper—The market is easy. Lake Copper can be had at 11.90c., although the companies continue to quote 12c. In a speculative way 11.85c. is asked for prompt delivery. Casting Copper is held at 11 25c. to 11.40c.

Lead—The prices are lower, several hundred tons have been released at 4.20c., and 4.15c. is now the best bid.

Lard Oil—The market is quoted at 57c. to 58c. for Prime City. Western on spot is quoted at 56c. to 57c.

Spelter—The market is stronger, and more and less nominal at 4.85c. to 4.90c.

Tin—A strong feeling rules the market, but little business is done. Sales have been made at 21.85c to 21.95c., according to time of delivery. Spot price is 21 90c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Pattern makers wanted, Birmingham Foundry Birmingham, Conn.

Mechanical draftsman, Swede, first-class ref., wants position. Anderson, 731 7th Ave., New York

Wanted—A draftsman with some machine shop experience. Address Box 93, Albany, N. Y.

Wanted—First-class pattern maker. Apply with refs. Sioux City Engine Works, Sioux City, Iowa

Prime cost & incidental charge clerk, exp'd and practical, wants sit. Bate, 369 President St., B'klyn

Wanted—Position as supt. or foreman; successful in the systematic mfg. of machine tools, automatic & interchg'ble mach'y. H., Box 310, Florence, Mass

Ass't Draftsman Wanted—Must have exp. in designing Corliss eng. Right man would have permanent pos. Hewes & Phillips Iron W'k's, Newark, N. J

Wanted—Several machinists familiar with repair work in a large jobbing shop in Western Indiana; give reference. J. A. P., AMERICAN MACHINIST.

Wanted—Assistant foreman and several 1st-class lathe and erecting hands in Corliss engine shop Permanent work. Box 13, AMERICAN MACHINIST.

Wanted—About July 5, a 1st-class brass molder Address, for interview, W. W. Kirley, Mechanical Engineer, Utica, N. Y.

Wanted—First-class foreman who can handle men to advantage. Give age, salary expected, and references. E. M., AMERICAN MACHINIST.

Wanted—Machinist with technical training and 7 years' drawing room exp., would like a change, in view of getting closer to New York. AX, AM. MACH

Wanted—Position as foreman or superintendent. Experienced from sewing machine to locomotive work. Have handled men over 10 years. Set piecework prices, estimated cost, etc. Practical, AM. MACH.

Wanted—About July 5, position as foreman by practical and progressive machinist (age 28); can design tools and jigs, and economize labor; good reference. Address Box 7, AMERICAN MACHINIST.

Positon wanted by young, married mech. draftsman and designer, junior member Am. Soc. Mech. Eng., thorough technical education, shop experience, and several years in drafting room on heavy & light work; references. Norwegian, AM. MACH.

Wanted—Three or four boys to learn the machinist's trade, not less than 17 years of age, and to have a fair common school education. Application must be made in own hand-writing. The Hendey Machine Company, Torrington, Conn.

The superintendent of an engine and boiler shop working 200 men, and owning patents of Corliss engines now being built, has $8,000 cash, 20 years' experience, desires an interest in a modern shop in the West. J. E. J., AMERICAN MACHINIST.

Wanted—A good tool maker. State if you understand large or small tool work, if you are a draftsman, have ever been a foreman or want to be, or if you can design special machinery. Also state nationality, age and pay. X., AMERICAN MACHINIST.

Wanted—By a concern near New York, a man who is thoroughly familiar with the manufacture of pipe cutting and threading mach'y, steam & gas fitters' tools, etc. Must be a good draftsman, capable of taking charge of men, & a "hustler." Exp. & salary exp'd.; also age. Pipe Machine, AM. MACH.

A comp. man desires a place in a manufactory as working foreman or supt. Lengthy exp. with modern methods on interchangeable work, devising tools and adapting mach'y to produce economical results, exp'd on mach. tools, dynamos, electrical instru'ts, small tools, etc., hardware, writing mach. etc. Thorough draftsman; good executive. A. Z., 72 John street, N. Y.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d-hd lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Presses, Wire Form'g Mchy. Am. Tool Wks, Clev, O.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Complete mach'y for mfg. horseshoes delivered by L. Ingermann, Minden, Westphalia, Germany.

Stolpe's Universal Punch is new and the best; write for circular. Stolpe, 154 W. 27th St., N. Y.

ROSE POLYTECHNIC INSTITUTE.
Terre Haute, Ind. A College of Engineering. Well-endowed, well-equipped. Courses in Mechanical, Electrical, Civil Engineering and Chemistry. Extensive Machine Shops, Laboratories, Drawing Rooms, Library. Expenses low. Address H. T. EDDY, Pres.

FOR SALE.
Established 1831.
Will sell half or whole interest in machine shop, patterns, tools and stock having a good jobbing, and manufacturing paper and other specialties business Building with power leased on reasonable terms. Inquire of
W. H. MINOR, Brattleboro, Vermont.

BRASS AND BRONZE CASTINGS
A SPECIALTY.
By a molder of 50 years experience. Castings guaranteed true to pattern. Get my prices.
GEORGE HIBSCH, 4 1-2 Plain St., Albany, N. Y.

AMERICAN AND FOREIGN PATENTS.
We refer to well-known men and establishments in the machine trades for whom we have done business.
Epitome of the World's Patent Laws and Statistics Sent Free on Application.
(Registered English Patent Agent, according to Act of Parliament.)
F. W. BARKER'S PATENT AGENCY,
THE BENNETT BUILDING, 93-99 NASSAU ST., N.Y.
Monument Chambers, King William St., London, E. C., England.

ANNOUNCEMENT.
CLEVELAND, June 1st, 1892.
This is to give notice that Hill, Clarke & Co., Chicago Branch, have been made selling agents for our tools in the States of Illinois, Wisconsin, Minnesota, Iowa and Missouri. A line of our machines can be seen at their store, No. 14 So. Canal St., Chicago, Ill.
BARDONS & OLIVER.

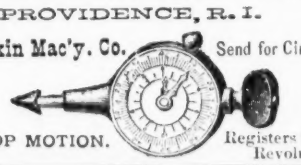
TO LET.
The Engine Works at Newburgh, N. Y., at present occupied by Wm. Wright, is offered to let from May 1st, 1892.
The Property consists of
MACHINE SHOP, FOUNDRY, BOILER, FORGE AND PATTERN SHOPS, with a full equipment of tools.
The works are located in the heart of the city, and convenient to railroad and river transportation.
For terms, apply to
HOMER RAMSDELL, NEWBURGH, N. Y.

If you want tools, send for circular,
HOW TO GET $5.00 WORTH FREE.
RANDALL,
105 Chest. Ave., Springfield, O.

STEEL TUBES
WELDLESS
SMOOTH - COLD DRAWN
John S. Leng's Son & Co. New York.

POPULAR AND INSTRUCTIVE BOOKS
FOR ENGINEERS AND FIREMEN,
By STEPHEN ROPER, Engineer.
Embracing all branches of Steam Engineering. They are the only books of the kind ever published in this country, and are so plain that any engineer or fireman can easily understand them
Descriptive Catalogue Mailed Free.
EDWARD MEEKS, Publisher,
No 1012 Walnut St., PHILADELPHIA, PA.

ANNOUNCEMENT.
Having new and improved features on Milling Machines, that we desired to place on the market, we have by mutual consent closed our contract with the parties heretofore making these tools. These improved tools we will offer in the near future, and trust they will receive the liberal patronage enjoyed by our other productions.
THE LODGE & DAVIS MACHINE TOOL CO.,
Cincinnati, Ohio.

THE STANDARD REVOLUTIONS COUNTER.
PROVIDENCE, R. I.
A. B. Pitkin Mac'y. Co. Send for Circular.

PAT. STOP MOTION. Registers 2,000 Revolutions.

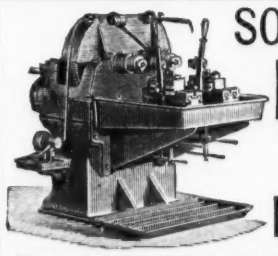
Assignee's Sale. Manufacturing Plant.
DULUTH, MINN.
All the land, buildings, fixtures machinery, tools, patterns, patents and property of IRON BAY COMPANY will be sold by the assignee on very favorable terms.
Plant is at West Duluth. Main buildings are brick with slate roof, and fixtures and machinery cost $75,000 two years ago. Buildings at present value, land at cost and the machinery and fixtures attached and forming a part of the real estate inventory $125,000. The unattached machinery, tools, unmanufactured material and patterns at a very low estimate aggregate $75,000. This plant is especially equipped for the manufacture of various forms of BOILERS, ENGINES, SAW MILL and MINING MACHINERY, and FOUNDRY WORK OF ALL KINDS, and is in condition to be run at any time, having been shut down since the 1st of May, 1892. UNEXCELLED SHIPPING FACILITIES; RAIL OR BOAT.
Sealed bids for this property as a whole, or separately for the land, buildings and machinery attached as one parcel, and for whole or any part of balance, will be received up to noon, July 1st, 1892. SEND FOR DESCRIPTIVE CIRCULAR AND TERMS OF SALE.
The right to reject any and all bids is reserved.
F. W. PAINE, Assignee,
324 West Superior St., Duluth, Minnesota.

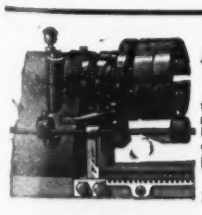
PURE FEED-WATER
For Steam Boilers.
THE BUNNELL FILTER AND PROCESS
Furnishes Steam Boilers with water that is absolutely freed from all scale producing substances. Guaranteed or no sale.
BRADLEY & COMPANY,
SYRACUSE, N. Y.

BOOKS ON BOILERS.
THURSTON'S MANUAL OF STEAM BOILERS, profusely illustrated. 8vo, cloth, $6.00
THURSTON'S HANDBOOK OF ENGINE AND BOILER TRIALS, with illustrations. 8vo, cloth.....$5.00
Mailed and prepaid on receipt of price.
JNO. WILEY & SONS, NEW YORK.

PROGRESSIVE EXAMINATIONS
For LOCOMOTIVE ENGINEERS AND FIREMEN.

What must be known to go firing; what to learn each year—and where to learn it. 3 examinations, 300 Questions AND ANSWERS TO THEM. Official on several roads. Author 10 years on a locomotive. 17 colored plates showing all signals, color and position, train or engine. How to run a locomotive; Accidents; Emergencies; 100 pages, pocket. Send 50 cents to the Author, JOHN A. HILL, 912 Temple Court, N. Y.


SOLID DIE BOLT THREADING AND TAPPING MACHINES.
Will do more accurate BOLT THREADING than any machine made.
Changes from one size to another can be made in one minute.
No complicated head to get out of order.
BUILT IN 3 SIZES, 2, 4 AND 6 SPINDLE, BY
WEBSTER & PERKS TOOL CO.,
Cor. Spring & Monroe Sts., Springfield, Ohio, U. S. A.


ADAMS
Automatic Bolt-Threading & Nut Tapping Machine.
Made in all Sizes to Cut from 1-4" to 6".
The simplest and most durable machine in existence. The threading head is made entirely of steel. No links, levers, springs, caps, cases, blocks or die rings in or about the head. Separate Heads and Dies Furnished. Write for descriptive circular and price list to
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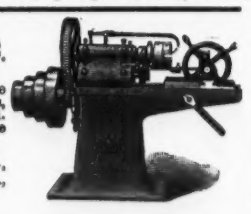
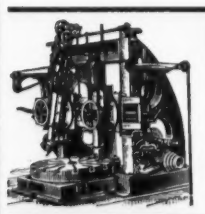
Agents for Great Britain, CHARLES CHURCHILL & CO., Ltd., 21 Cross Street, Finsbury, London, E. C., England.
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COMBINING EVERY IMPROVEMENT.
14 SIZES—FROM 5 TO 20 FEET.
BETTS MACHINE COMPANY,
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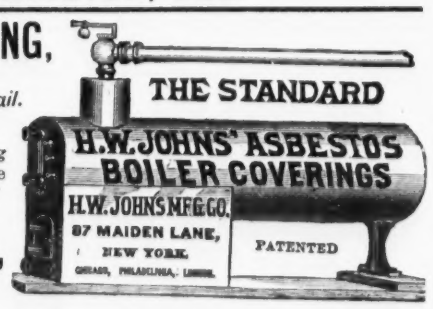
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.


✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Design & superintendence of mach'y. Drawings, etc., made. Claud Mantle, 598 E. 134th St., N. Y.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

For Sale—Paper Cutting Machine, Patent No. 474,341, issued May 3, 1892. Please address P. A. Malm, 334 E. 77th Street, New York.

Wanted—A specialty to manufacture either heavy or light work. We have splendid facilities. Address "Manufacturers," Rockford, Ill.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R. I

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 203 Broadway, New York.

George D. Slade, dealer in molding sand of all grades, Waterford, N. Y.

Wanted—By an English engineering firm a good invention to manufacture and push; first-class refs. Send partic's to X. X., The International News Co., Breams Building, Chancery Lane, London, England.

For Sale—One Atlas plain slide valve engine, 10x16, and one 42-12 boiler to go with the engine. Both in excellent condition. Fittings complete At a bargain. The Congdon Brake Shoe Co., 1014 Monadnock Building, Chicago, Ill.

Assignee's sale of manufacturing plant, Duluth, in running order; made specialty of mining and mill machinery, engines and foundry work; must be sold. Send for circulars. F. W. Paine, assignee, Duluth, Minn.

For Sale—Machine shop and foundry in a thriving village in central New York; orders to the mount of $1,700 now on hand; only cause of selling, poor health of owner. Address Box 9, care AMERICAN MACHINIST.

For Sale—Near N. Y. City, splendid equipment medium size mach. shop. Best substantial modern lathes, planers, etc., for eng. & gen. work. Splendid ass't of taps, etc, & some valuable pat. Doing good local business. Price $8,000. A. B., AM. MACH

Machine Tools in Stock.

ENGINE LATHES.

82 in. swing,	34 ft.	bed.		Whittier
78 do	9 ft.	between centers		Sellers
38 do	17 ft.	bed.	New	Fifield
30 do	14	do	do	do
27 do	16	do	do	Fifield
24 do	12	do	do	Fitchburg
24 do	12	do	do	Flather
22 do	10	do	New Pattern	Fifield
22 do	12	do	do	do
22 do	12	do	New	Blaisdell
22 do	8	do	do	Flather
22 do	10	do	do	do
20 do	8	do	do	do
20 do	10	do	do	do
18 do	8	do	do	do
18 do	10	do	do	do
18 do	8	do	do	Blaisdell
18 do	16	do	do	do
16 do	6	do	do	Flather
16 do	6	do	do	Blaisdell
15 do	6	do	do	Flather
14 do	6	do	do	do
14 do	6	do	do	Blaisdell
12 do	6	do	do	do

PLANERS.

42 in. wide,	42 in. high,	12 ft.	long, 2 heads	Gleason
36 do	36 do	8	do	Pease
30 do	30 do	8	do	do
30 do	30 do	8	do	Whitcomb
30 do	30 do	8	do	Flather
26 do	26 do	6	do	do
24 do	24 do	6	do	do
24 do	24 do	6	do	Whitcomb
22 do	22 do	5	do	do
22 do	22 do	6	do	Flather

SHAPERS.

12, 16, 20 and 24 inch stroke	Eberhardt
15 and 24 inch stroke	Hendey
32 inch stroke with key-seating attach.	Walcott

UPRIGHT DRILLS.

20, 21, 25, 28, 30 and 36 inch swing	Prentice
20, 23, 25, 28 and 34 inch swing	Blaisdell
30 inch swing Radial Drill	Baush

HILL, CLARKE & CO.,
156 OLIVER ST., BOSTON, MASS.

BEVEL GEARS,

Cut Theoretically Correct.
For particulars and estimates apply to
HUGO BILGRAM,
MACHINIST,
Successor to
BREHMER BROS.,
440 N. 12th St., Philadelphia, Pa.

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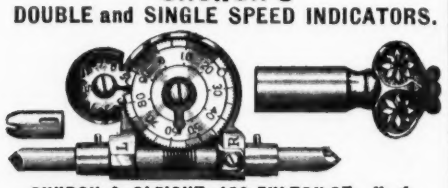
DOUBLE and SINGLE SPEED INDICATORS.



CHURCH & SLEIGHT, 109 FULTON ST., N. Y.

Second Hand and New Machinery

ON HAND.

10 ft. x10 ft. x16 ft. Planer.	2 Heads.		
62 in x48 in x17 ft.	do	1	do
54 in. x48 in. x12 ft.	do	2	do
54 in. x42 in. x24½ ft.	do	2	do
46 in. x33 in. x30 ft.	do	2	do
42 in. x4' in. x 8 ft.	do	1	do
39 in. x36 in. x12 ft.	do	1	do
36 in. x36 in. x10 ft.	do	1	do
30 in. x30 in. x7 & 8 ft.	do	1	do
26 in. x26 in. x6 ft.	do	1	do
25 in. x24 in. x6 ft.	do	1	do
22 in. x21 in. x5 ft.	do	1	do
96 in. Raising Blocks to 13 ft. x 26 ft. Bed Engine Lathe.			
50 in. x30 ft. Bed Triple Geared.	New	do	do
48 in. x22 ft. do	do	do	do
42 in. x17 ft. do	Al	do	do
32 in. x12, 14, 16, 18 ft. Bed.	New	do	do
28 in. x12, 14, 16, 18 ft. do	do	do	do
21 in. x10, 12 ft. do	do	do	do
20 in. x 7½ & 8 ft. do	2d Hand	do	do
18 in. x 6, 7 & 8 ft. do	New &	do	do
17 in. x 8 ft. do	do	do	do
16 in. x 6 & 8 ft. do	do	do	do
15 in. x 6 & 8 ft. do	do	do	do
14 in. x 6 ft. do	do	do	do

2,000 lb. Bement Steam Hammer.
Car Axle Lathe Bement.
9 & 12 in. Stroke Slotters.
15, 16, 18, 25 in. Crank Shapers.
20, 24, 26 & 30 in. Geared Shapers.
20, 22 24, 28, 30 & 36 in. Drills.
Bolt Cutters.

GEO. PLACE MACHINE CO.,
120 BROADWAY, NEW YORK.

WATCH THIS SPACE

We have added to our already extensive Warerooms a large department for **Second-Hand Machinery,** and will have constantly on hand a large stock of **Good Tools** for quick delivery.

SPECIAL INDUCEMENTS
—IN—
SECOND-HAND MACHINERY.

ENGINE LATHES.

14 in. x6 ft. Bogert, H. S., Elevating Rest, Chuck fitted.	A1 condition.
15 in. x5 ft. Blundel, Elevating Rest, 2 Chucks, fitted.	Good order.
14 in. x6 ft. Windsor, H. S., Elevating Rest, 2 Chucks.	Good as new.
10 in. x5 ft. Reed, H. S., Elevating Rest, Chuck fitted.	" "

PLANERS.

22 in x22 in. x5 ft. Pease, with 12 in Chuck.	Good as new.
22 in. x22 in. x5 ft. Whitcomb, complete.	" "
19 in. x17 in. x5 ft. Whitcomb.	A1 condition.

DRILLS.

2 20 in. Davis, Wheel Feed, Quick Return.	Good order.
1 W. & R. 4-Spindle Sensitive Drill.	A1 condition.
1 No. 2, 3-Spindle Garvin Elevating Table.	" "
1 No. 4, 6-Spindle Garvin " "	" "

MISCELLANEOUS.

2 No. 1 Brown & Sharpe Plain Millers, complete.	A1 condition.
1 No. 1 Garvin Miller, Rack Feed, not B. G.	" "
1 No. 3 Cincinnati Universal Miller, Rack Cutting Attachment, Lot of Tools, very complete.	Good as new.
1 Single Spindle Garvin Profiler.	" "
1 12 in. Juengst Crank Shaper, complete.	A1 condition.
1 No. 2 Brown & Sharpe Screw Machine and Tools.	" "
1 Jones & Lamson Lettering Machine.	Good as new.
1 15 in. x6 ft. Am. Tool & Machine Co.'s Fox Lathe, Square Arbor, Comp. Slide Rest, complete.	" "

Write for list of over 350 new and second-hand tools in stock, for immediate delivery.

THE GARVIN MACHINE COMPANY,
LAIGHT & CANAL STS., NEW YORK

JESSOP'S STEEL

FOR TOOLS, DRILLS, DIES, &c.

ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LD.

R. I. TECHNICAL DRAWING SCHOOL.

Providence, R. I.

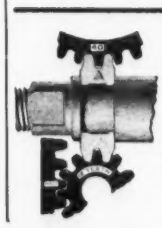
AN ENGINEERING SCHOOL

Providing one and two year courses in Mathematics, Mechanics, Machine Drawing and Design. Exceptional facilities offered to special students. 6th year begins September 19, 1892. For catalogue and further information apply to
GARDNER C. ANTHONY, Director.

World's Fair Exhibitors

ATTENTION.

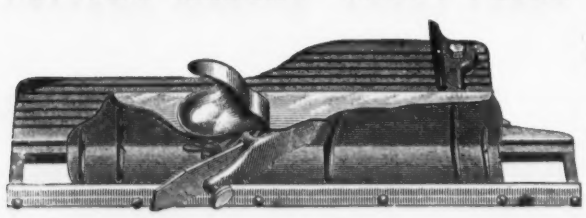
Do you desire the services of a reliable company to receive, install and superintend your exhibit during the **World's Columbian Exposition?** We can save you money. Unexceptional references. Write for pamphlet and particulars.
CHICAGO COMMERCIAL COMPANY,
501, 502, 503 Home Insurance Bldg., Chicago.



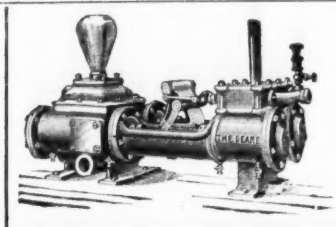
CLOUGH'S
Combination Gear Cutters.

One pair cuts a pitch from 12 to a rack, inclusive. Of variable shape and interchangeable. These cutters are kept in stock and orders filled promptly. Special cutters and sizes made to order promptly. For descriptive circular, prices and discounts, address
R. M. CLOUGH,
TOLLAND, CONN.

PATTERN MAKERS' SHOOT PLANE & JACK BOARD.



A. J. WILKINSON & CO.
Box 3600.
BOSTON, MASS.
SEND FOR CIRCULAR.

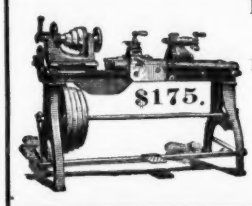


THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

CRESCENT STEEL CO.
PITTSBURGH.
CHICAGO.
NEW YORK.

HAVE YOU TRIED

Reducing the cost of getting out work by using better **STEEL** for your Tools?
We can be of service to you in this direction.



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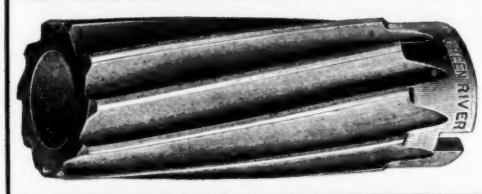

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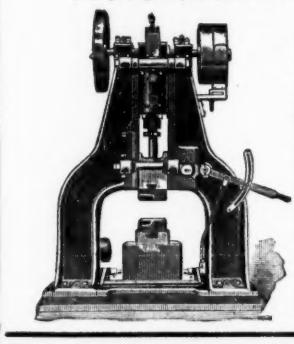

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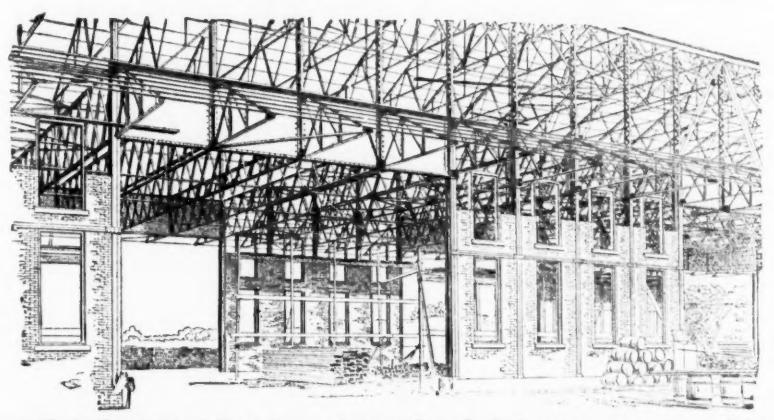

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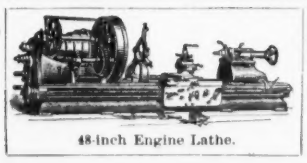
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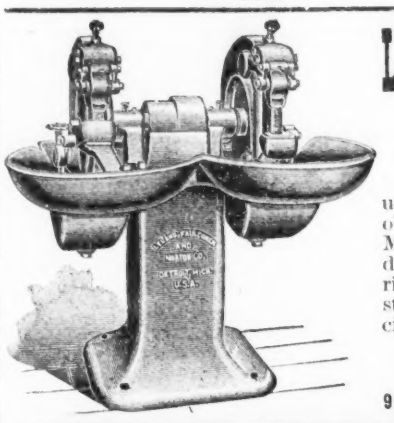

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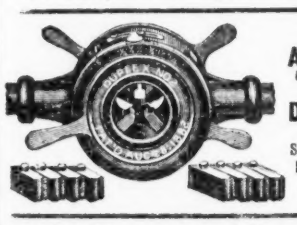

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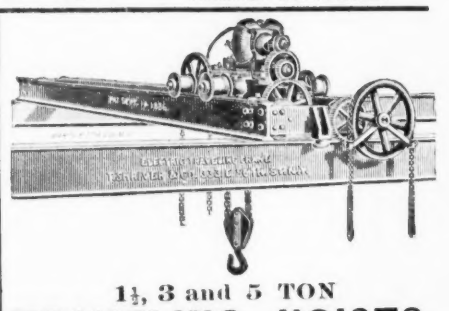

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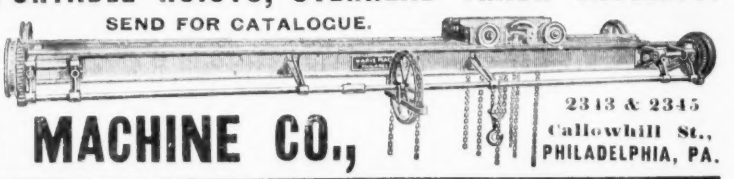

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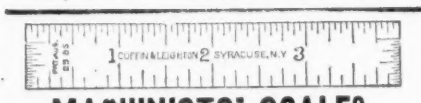

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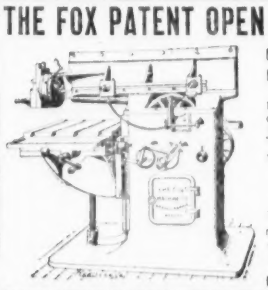

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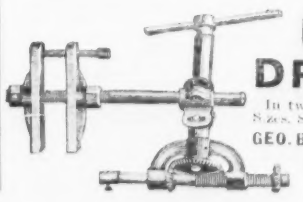

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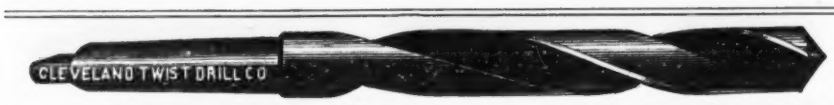

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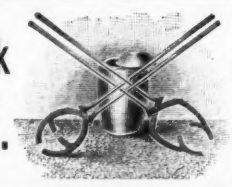

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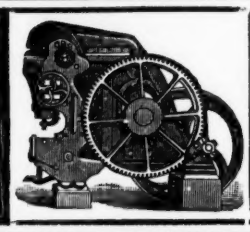

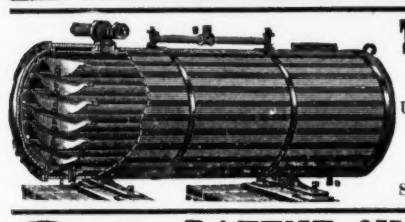

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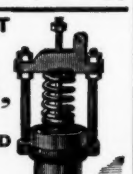

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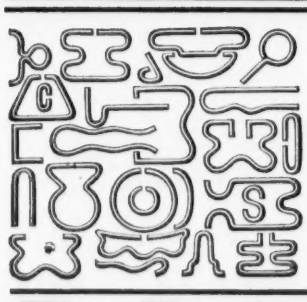

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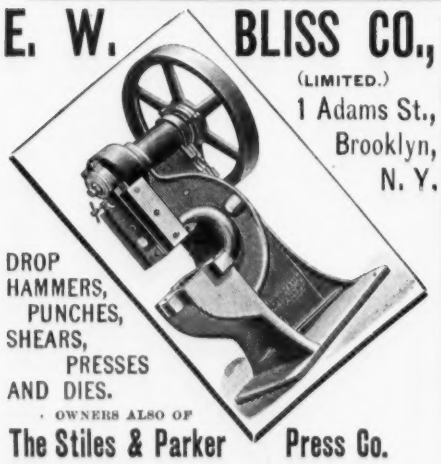

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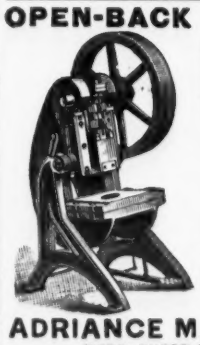

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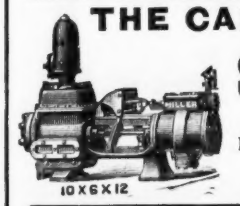

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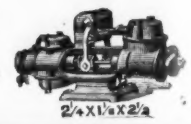

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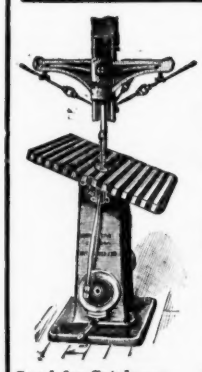

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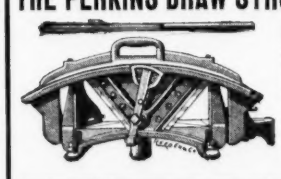

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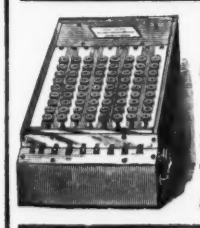

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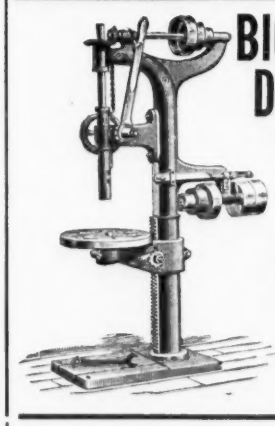

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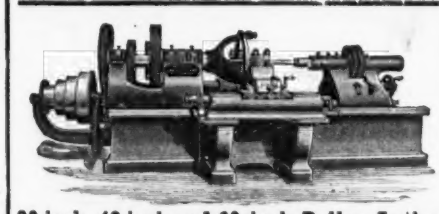

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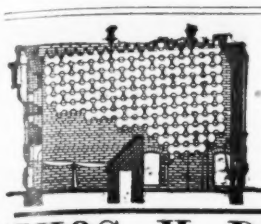

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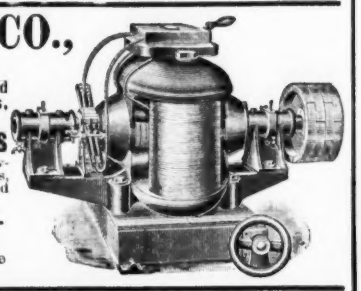

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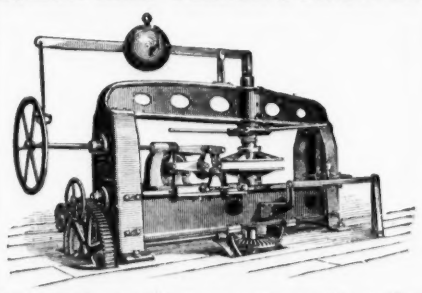

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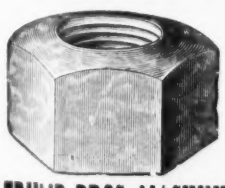

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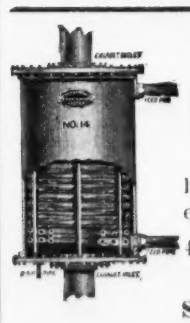

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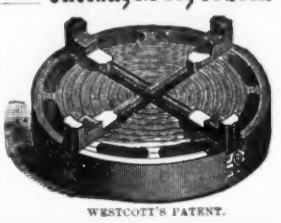

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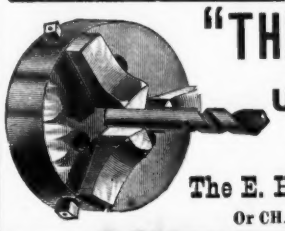

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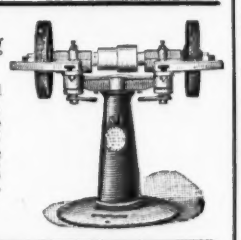

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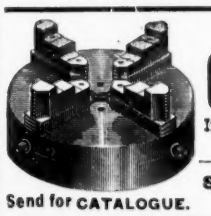

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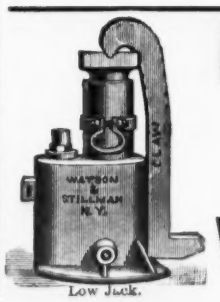

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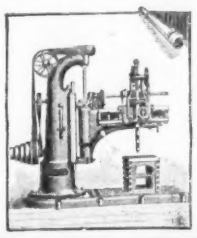

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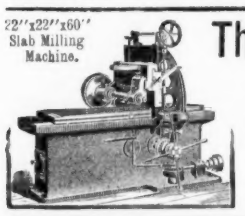

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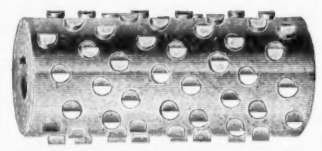

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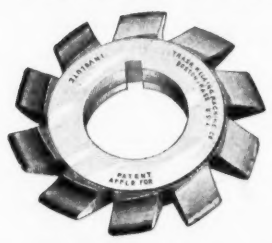

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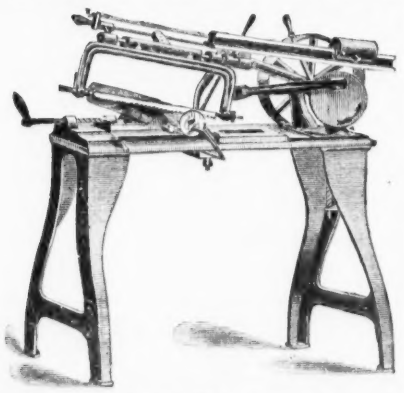

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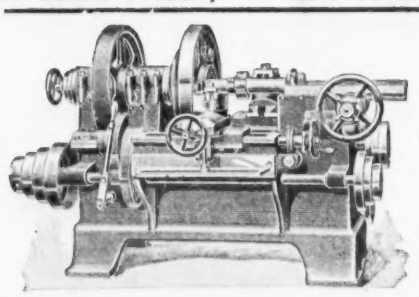

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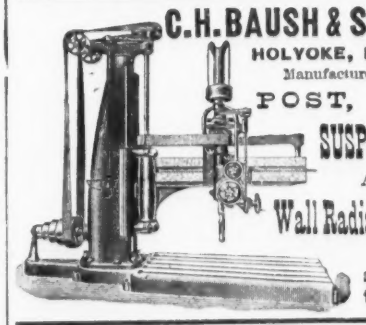

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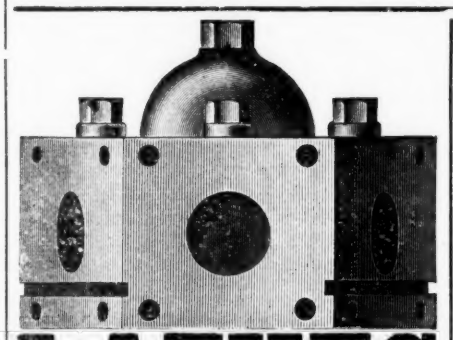

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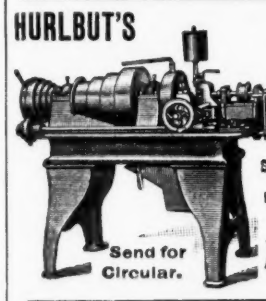

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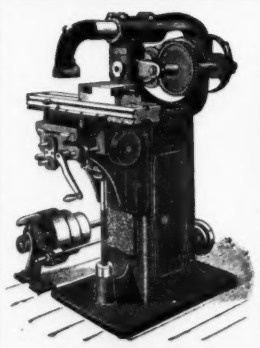

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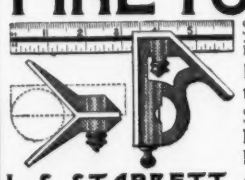

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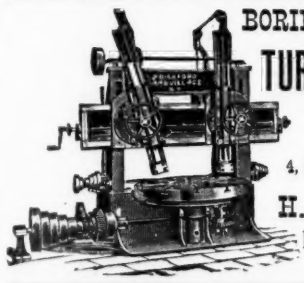

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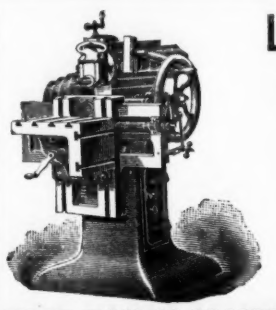

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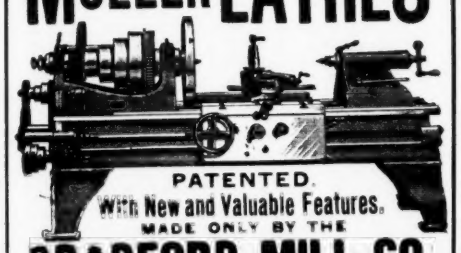

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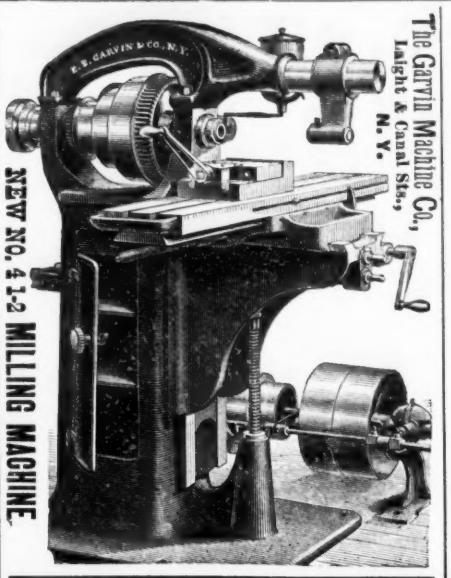

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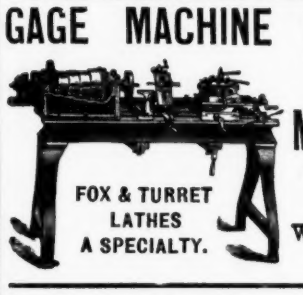

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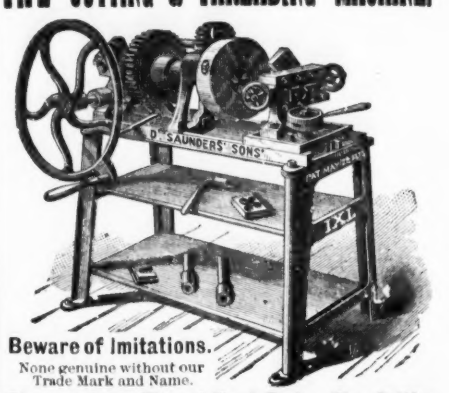

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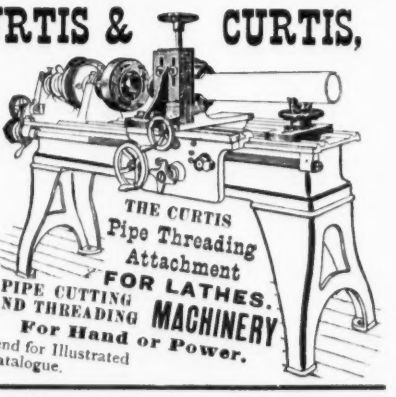

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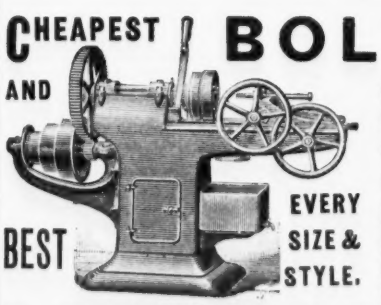

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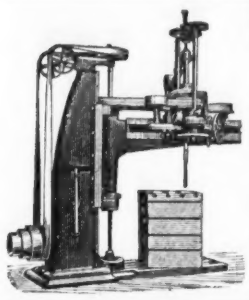

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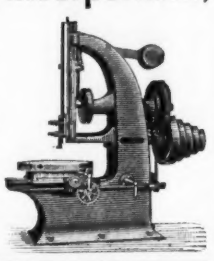

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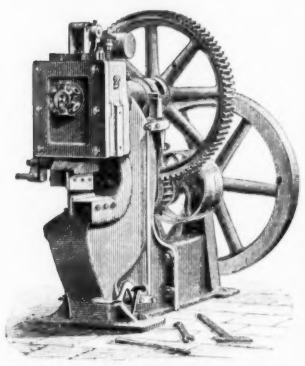

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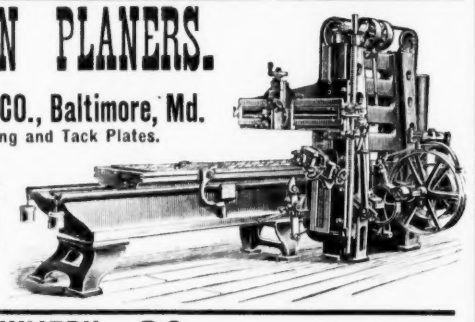

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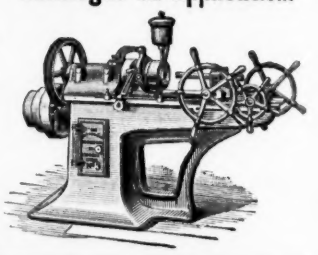

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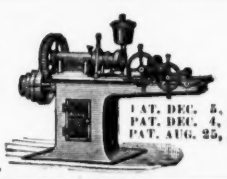

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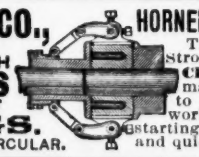

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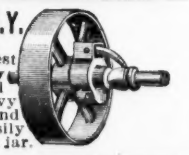

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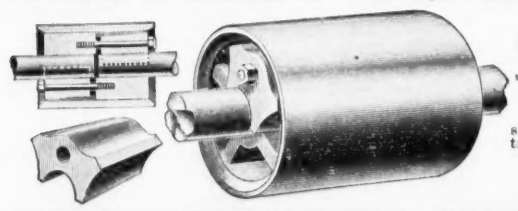

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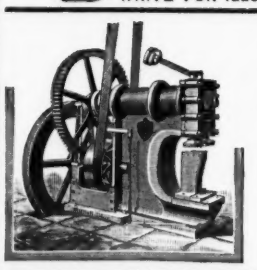

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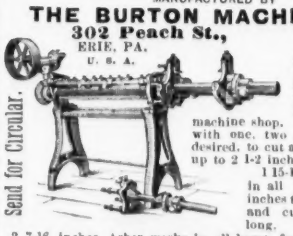

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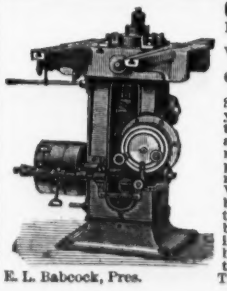

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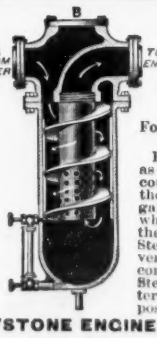

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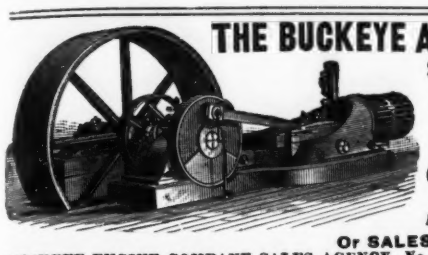

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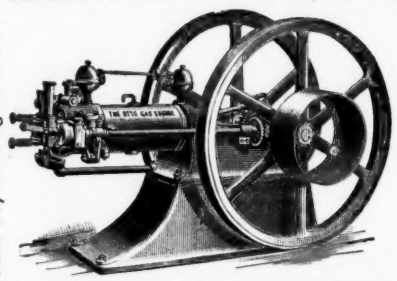

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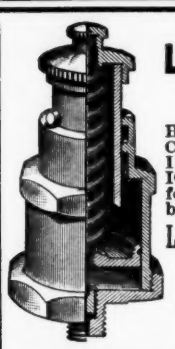

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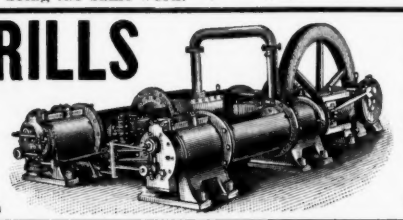

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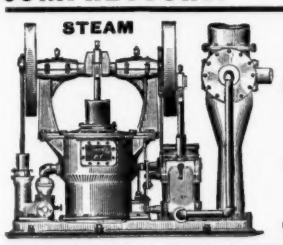

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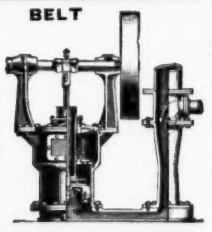

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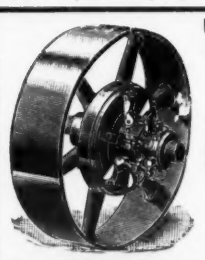

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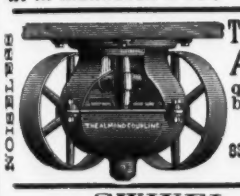

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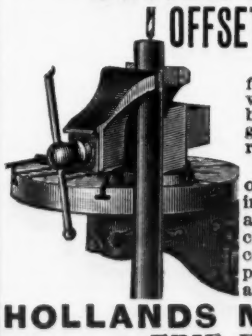

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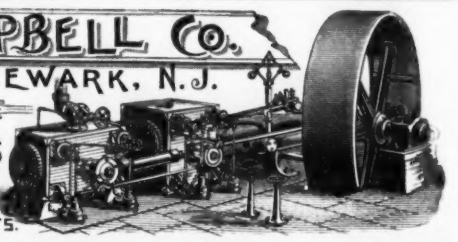

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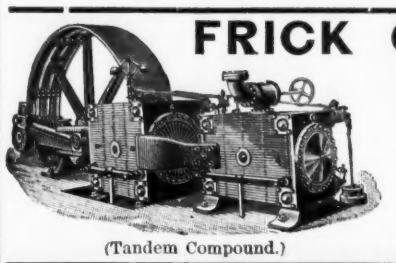

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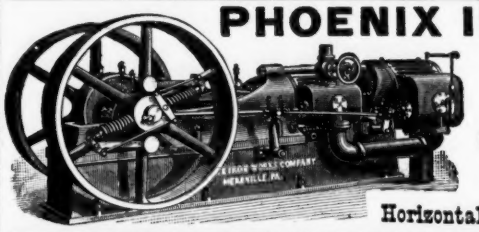

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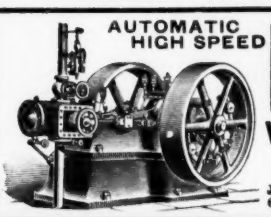

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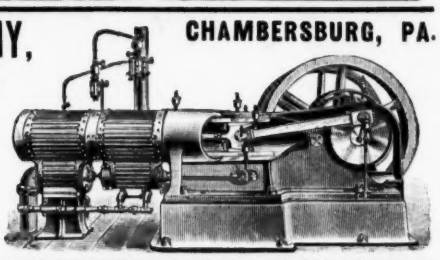

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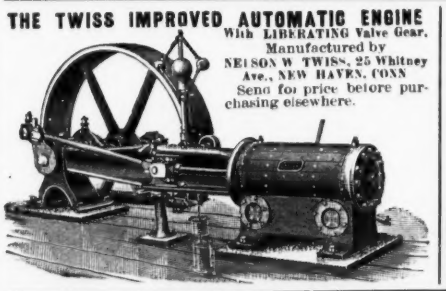

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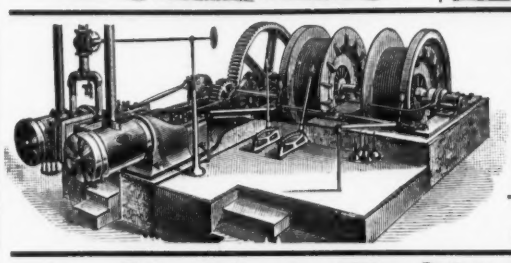

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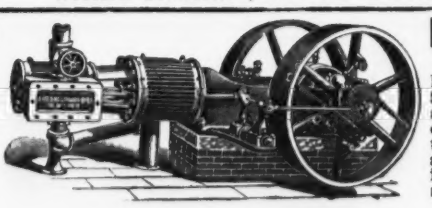

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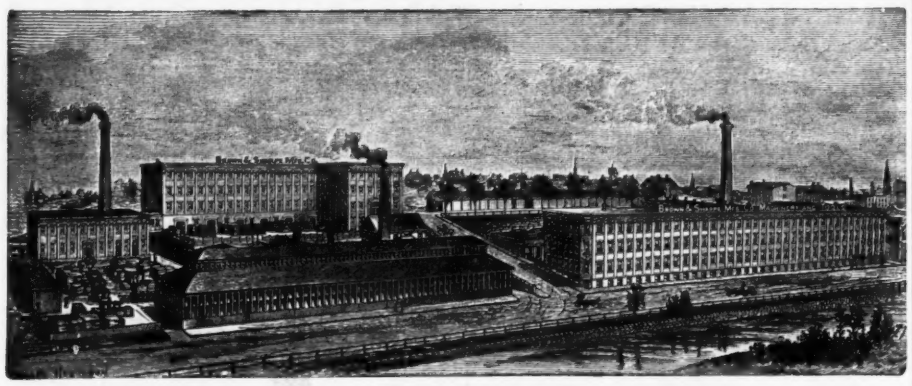

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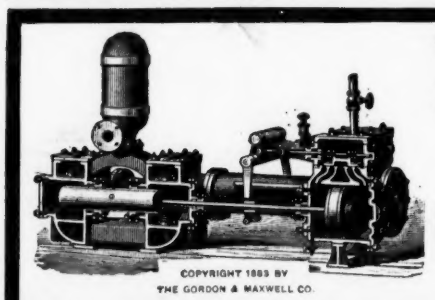

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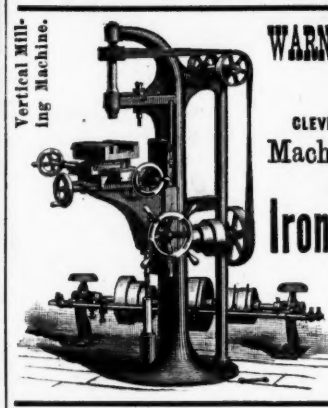

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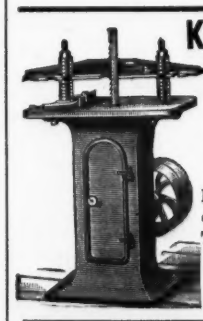

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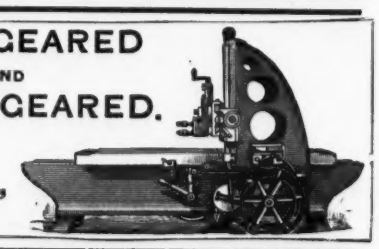

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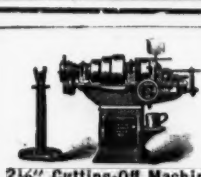

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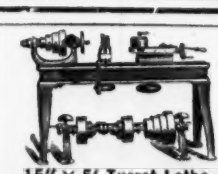

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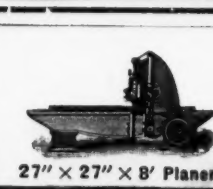

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